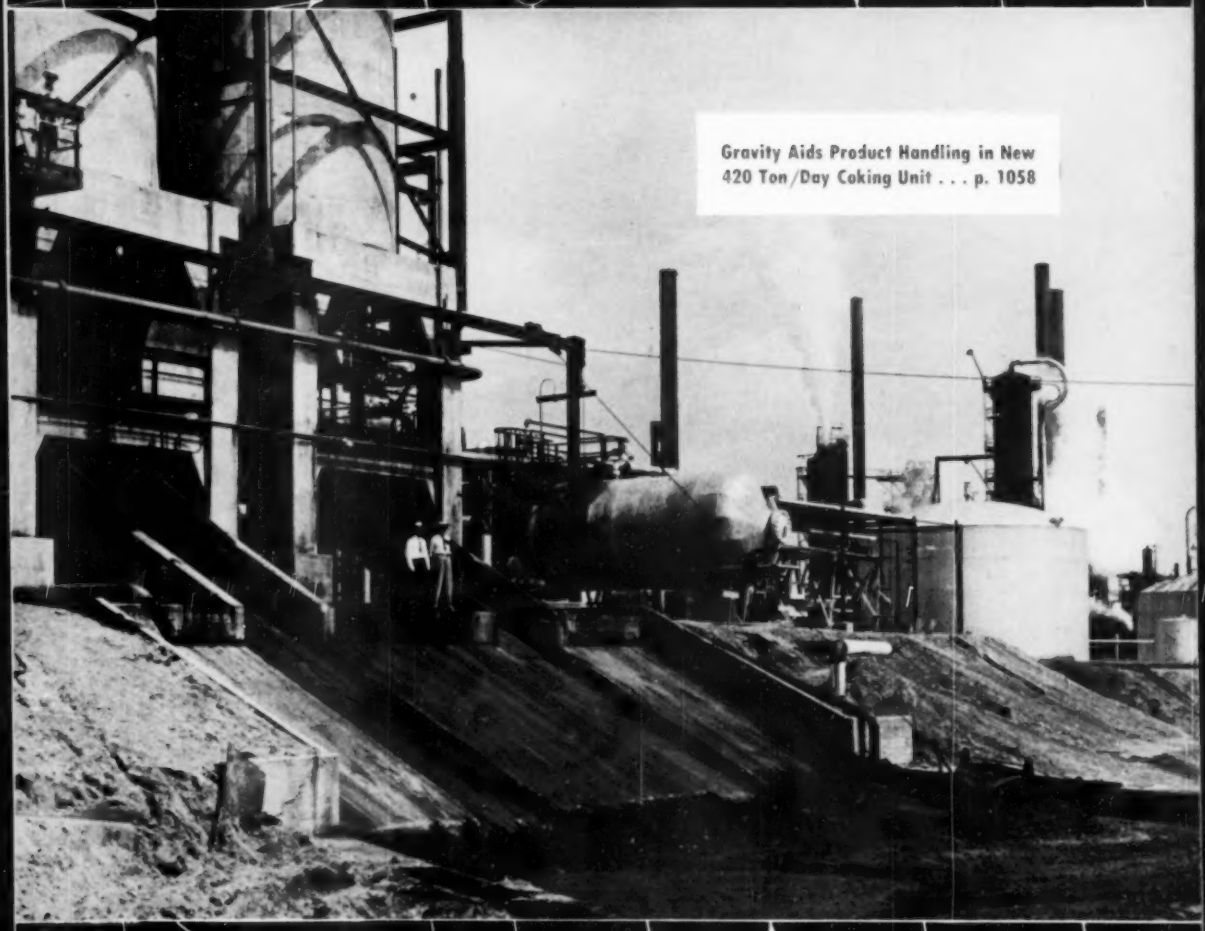
OCTOBER, 1950
VOL. 5, NO. 10

PETROLEUM PROCESSING

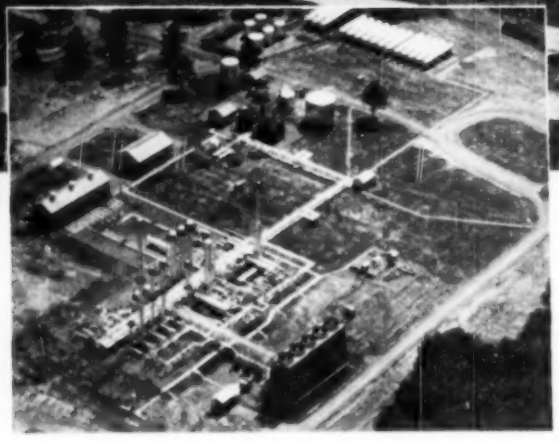


Gravity Aids Product Handling in New 420 Ton/Day Coking Unit . . . p. 1058

13 in '49

THE *Opelousas Gasoline Plant*

One of the 13 plants completed by HUDSON in '49. The plant pictured below is one of the five projects awarded HUDSON in 5 years by the major oil company which owns and operates the plant . . . good evidence of the satisfaction of owners and operators of HUDSON built plants.



From Colorado to Alabama and abroad, at elevations from sea level to a mile, at atmospheric temperatures of minus 40° F to plus 110° F, under process pressures from high vacuum to 8000 pounds per square inch, HUDSON plants have built the HUDSON reputation for dependability and performance.

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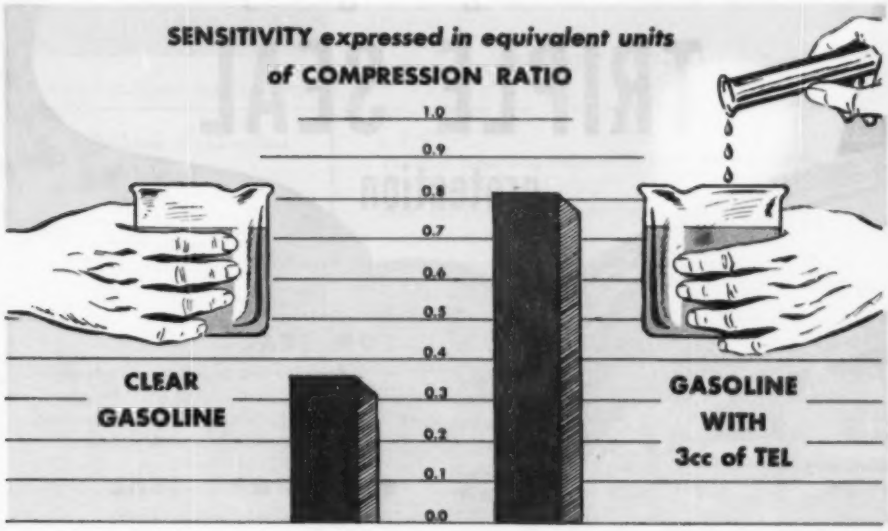
Extra "Sensitivity" of Leaded Gasoline

helps refiners meet requirements of modern engines



GENERALLY SPEAKING, the higher the Research octane number of fuels having the same Motor Method rating, the better their performance on the road. The difference between these two ratings is often called "jump" and is one measure of fuel "sensitivity."

In tests of sixty-six regular and premium fuels the difference between the Research and Motor octane numbers was, on the average, greater by 1.3 octane numbers after the addition of 3.0 cc tetraethyllead.

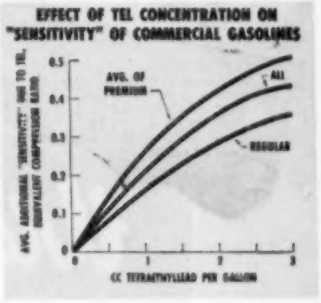
While sensitivity or jump is usually expressed in octane number units, a more realistic evaluation is obtained when it is expressed as equivalent units of compression ratio. This is true because octane units, in terms of engine performance factors, get bigger toward the upper end of the scale. The chart above shows the additional sensitivity contributed by tetraethyllead when measured on the compression ratio basis.

Here the average improvement in sensitivity after the addition of 3.0 cc tetraethyllead is 0.44 ratios. On the average, the sensitivity of leaded fuels is more than twice the sensitivity of the clear fuels, expressed as equivalent units of compression ratio.

Although four of the fuels—on an octane number basis—showed no improvement in sensitivity after the addition of tetraethyllead, *all* of the sixty-six fuels showed an improvement on a compression ratio basis.

Another important finding is shown in the chart at right—the higher the concentration of tetraethyllead, the greater the improvement in sensitivity.

As automobile manufacturers have improved the design of engines by taking advantage of the sensitivity of motor fuels, any feasible method for improving fuel sensitivity without lowering the Motor Method rating has become of distinct advantage to the refiner. In this evolution tetraethyllead has become increasingly valuable through its contribution to fuel sensitivity.



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Since the first of the UOP Platforming units went on stream at the Muskegon, Michigan, refinery of Old Dutch Refining Company in October of 1949, six more progressive-thinking refiners have turned to this new process for the octane improvement of straight run gasolines. • These six additional units now planned or under construction, will offer the

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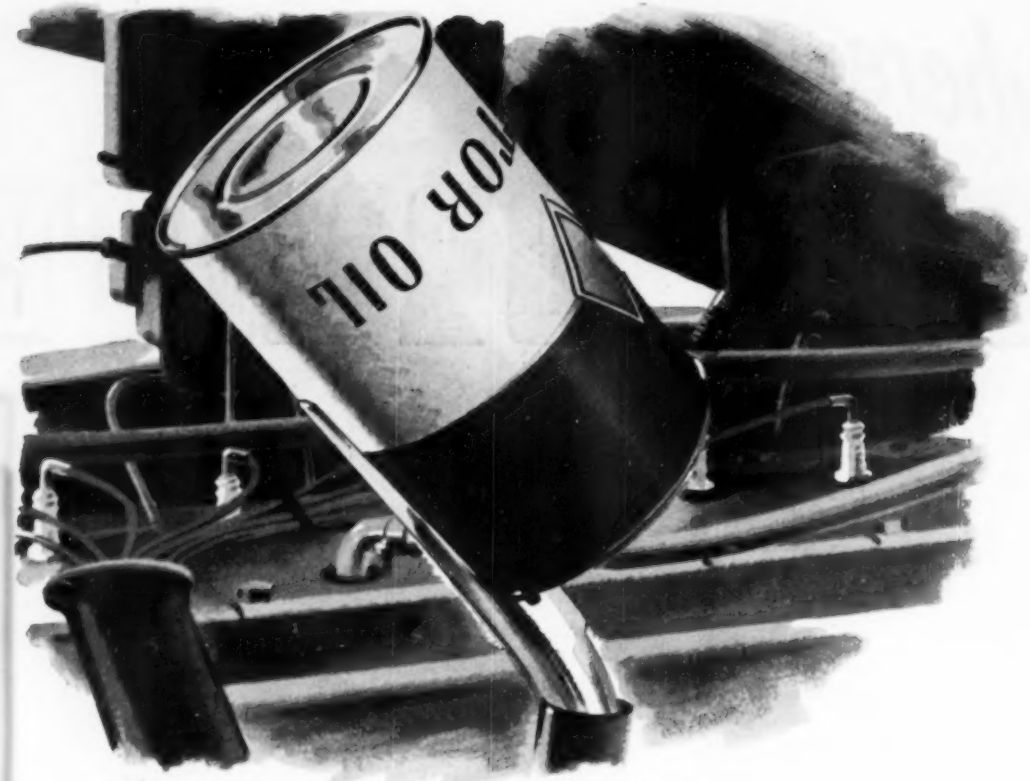
same advantages which have been proved so conclusively by the commercial operation of the first unit at Muskegon . . . advantages which include the improvement of straight run gasoline to better-than-premium-quality and the resulting increase in gallonage at the point of sale. • Old Dutch has proved the point. Now six more refiners have specified Platforming. When will you do the same?



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WHEN PERFORMANCE COUNTS . . . CALL ON CYANAMID

What's Happening!

Important Current News Summarized for Refiners

EXPANSION

Bay Petroleum Corp. is enlarging capacity of its Chalmette, La., refinery from present 12,000 b/d to 16,000 b/d in connection with a complete modernization of the plant. A new 6,000 b/d Fluid catalytic cracking unit will be installed, with design being handled by Universal Oil Products. Procon, UOP's new subsidiary, is handling construction, and completion is scheduled for the latter part of 1951.

Canadian Oil Refineries will build a new $18,000,000 refinery to process Alberta crude at Froomfield, Ont., 2 miles from Sarnia. The plant will have 20,000 b/d of capacity, and will include atmospheric and vacuum distillation, catalytic cracking, catalytic reforming and catalytic polymerization. Stone and Webster Engineering Co. have been appointed project managers. Crude will be supplied by tanker from Superior, Wisc., eastern end of the Interprovincial pipe line now under construction. The new plant is scheduled to begin operating in April, 1952.

British American Oil Co. has started an expansion program at its Moose Jaw, Sask., refinery to increase capacity to over 10,000 b/d from present 6,000 b/d rating. Project calls for a Fluid catalytic cracking unit which will require total feed stocks of more than 10,000 b/d, a 1,500 b/d thermal cracking unit, catalytic polymerization unit with 300 b/d or better capacity, coking unit rated at about 7,500 lbs. of coke per hour, and auxiliary equipment. UOP is doing design engineering on both Fluid unit and poly plant, and Process Engineers of Dallas have major construction contract. Entire project will cost several million dollars, and is scheduled for completion in 15 to 18 months.

Standard Oil Co. (Ohio) is installing two completely new crude oil distillation units at its No. 1 refinery in Cleveland. Each unit will be capable of running 22,500 b/d, making a total capacity of 45,000 b/d. Present plant capacity is 42,500 b/d. Arthur G. McKee Co. has construction contract, and completion is scheduled for Nov., 1951. Cost is estimated at $5,500,000.

Mid-West Refineries has begun construction of a 1,500 b/d Platforming unit at its Alma, Mich., refinery, and is increasing plant capacity to 10,000 b/d from its present rating of 4,200 b/d. Completion of the new facilities is expected early next year.

Continental Oil Co. will increase crude charging capacity at its Lake Charles, La., refinery from about 11,000 to 25,000 b/d as part of a $10,500,000 expansion program. Catalytic cracking facilities are included. Contracts are expected to be awarded this month, with completion scheduled for early 1952.

Continental Oil Black Co., newly formed firm owned jointly by Continental Oil Co. and Continental Carbon Co., will erect a $1,500,000 plant at Lake Charles, La., to manufacture 25 million pounds annually of high abrasion carbon black from oil. Plant will be built adjacent to Conoco's Lake Charles refinery.

Phillips Chemical Co. will shortly begin construction at Borger, Tex., of an additional plant for making high abrasion furnace carbon black, boosting present 45,000 tons/year capacity to about 80,000 tons.

• • •

WASHINGTON

An independent Defense Petroleum Administration will be set up to handle the oil end of the Interior Department's defense job. Authority on matters relating to oil and gas were delegated to Interior by President Truman in Executive Order 10161, issued Sept. 9 under the Defense Production Act. Interior officials had originally intended creating a central agency to handle all phases of department's defense assignment, which involves solid fuels and electric power as well as oil and gas.

Proposed petroleum agency, patterned after wartime PAW, will be headed by Interior Secretary Chapman as petroleum administrator, and will operate under a deputy administrator responsible to him alone.

Increase of TEL content of civilian avgas from present 3 cc. to 4.6 cc. may be ordered by Interior Department to free alkylate for blending into military avgas. Civil Aeronautics Board and commercial airlines have opposed increase on grounds that more lead would increase maintenance costs, hike fuel costs, and be more hazardous. Change would increase overall avgas output an estimated 10,00 b/d.

Information on these pages is obtained through the nation-wide news coverage services of PLATT'S OILGRAM NEWS

FOREIGN

Three European refinery projects are going ahead with aid from $5,225,000 in Marshall Plan dollars, according to a recent ECA summary.

French refinery at Dunkirk, which was virtually destroyed during World War II, is being rebuilt to have capacity 50% greater than prewar. Crude throughput of 28,000 b/d is expected. ECA is financing about 10% of estimated cost of $38,105,000.

Proposed refinery at Lingen will be the only completely new oil plant in Western Germany involving Marshall plant dollars. When plant is completed two years from now output will include about 7,500 b/d of gasoline, 1,500 b/d of Diesel oil, and 2,000 tons per day of coke. ECA is financing less than 8% of estimated cost of $8,670,000.

Italian refinery at Porto Marghera is slated for additional modernization, including a new 4,000 b/d reforming unit. ECA is financing about 27% of estimated cost of $2,000,000.

Capacity of new refinery at Cartagena, Spain, will be expanded, possibly 50% beyond previously announced plans to increase it to 20,000 b/d, according to California Texas Oil Co., which holds a 24% interest in the plant. The plant began operations last January with a capacity of 5,000 b/d.

• • •

NATURAL GASOLINE

Scurry County, Texas, natural gasoline plant to be operated by Sunray Oil Corp. for 35 operators (See PETROLEUM PROCESSING for Aug., 1950) will cost $6,800,000 according to the advisory committee of operators, and recover 70% of the propane in producing 420,000 gal. liquids, including isobutane, from 50,000 Mcfd. of gas. Vaughn & Taylor Construction Co. Wichita Falls, Tax., will lay 130 miles of low-pressure gathering lines, to be coated by Gulf Coast Pipe Line Coating Co., Corpus Christi. Committee now is negotiating with the Fluor Corp., Ltd. for construction of the plant proper.

• • •

MARKETS, PRICES

September was one of quietest months in oil market trading this year. Continued lack of general market offerings from primary suppliers, the well stocked position of most secondaries, plus rising water transportation rates and scarcity of dirty tank cars were the causes.

Prices, generally, were firm to higher. While buyers in the Midwest as well as along the Atlantic Seaboard showed considerable interest in making future commitments, they hesitated to do so on the basis of current transportation costs. Fall consumer demand is not yet off to a good start and, for the near-term position, jobbers and distributors apparently were well stocked.

Some substantiation of report that buyers are well stocked is seen in the fact that, during the four-week period ended Sept. 23, primary suppliers were able, according to API statistics, to boost their inventories of kerosine, gas oil and distillate fuels by more than 12,000,000 bbls.

Rise in shipping costs was sharp. In the space of a month the East Coast buyer of No. 2 fuel saw his transportation rate from the U. S. Gulf jump $1.43 per ton, or approximately 2c per bbl. Similar increases were reported in inland barge rates for Midwest buyers. The demand for transportation simply was greatly in excess of the supply. Military demand for tankers was no small factor in the rising ocean freight rates.

Principal product price developments in September, all on the up side, were (amount of increase in parentheses): Grade 26-70 natural gasoline quoted at 6.375c Group 3 and 5.875c Breckenridge (0.5c on both); Pennsylvania bright stock, 25c (2c); Mid-Continent solvent refined bright, 31c (5c); Group 3 No. 2 fuel, 8.125c (0.25c); Gulf Coast No. 2 fuel, 7.5c (0.25c).

Crude market generally was quiet. In the Scurry county, Texas, area, principal purchasers boosted their posted prices 7c per bbl., to top of $2.65 for 40 gravity and above oil. This places Scurry county on par with so-called Mid-Continent (Oklahoma, Kansas, North Texas) crude.

• • •

TRANSITION

Humble Oil & Refining Co. permanently closed down its San Antonio, Texas, refinery on Aug. 16. The plant had a rated capacity of 7,000 b/d. All of Humble's refining operations are now concentrated at Baytown.

California Oil Co. has bought and modernized the New York Lubricating Oil Co.'s plant at Bayway, N. J., for the processing, blending and packaging of motor oils.

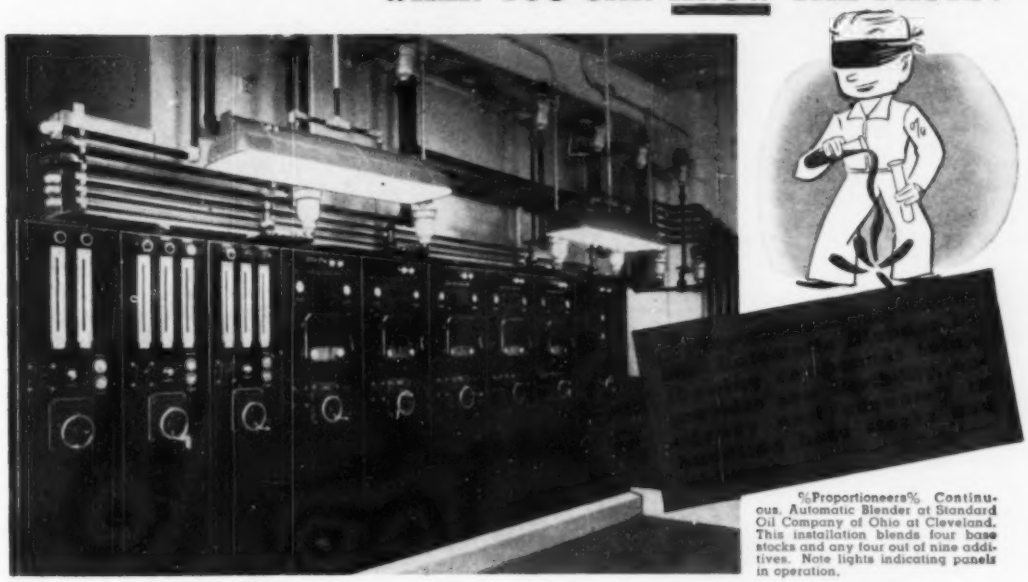
• • •

MISCELLANY

The price of tetraethyl lead is going up. Ethyl Corp. on Sept. 6 announced that the price of its anti-knock compounds will be increased about 4.5% Nov. 1 —to 58c per lb. of TEL content for motor mix and 63.5c per lb. of TEL content for aviation mix. Du Pont a week later announced that its prices would advance effective with Oct. 20 shipments—to 58.7c per lb. of TEL content for motor mix and 64.2c per lb. of TEL content for aviation mix.

WHY WORK *Blind*

WHEN YOU CAN KNOW THE FACTS?



%Proportioneers% Continuous, Automatic Blender at Standard Oil Company of Ohio at Cleveland. This installation blends four base stocks and any four out of nine additives. Note lights indicating panels in operation.

1 **Blender operation** is controlled from a single drum switch on master panel with "test" position during which individual components are recirculated within the machine and *totalizers show* whether component settings are correct.

2 **Production capacity** is controlled from master panel and can be altered within a 1 to 3 range without affecting the pre-set percentages of base stocks and additives.

3 **"Band Spread" feature** permits setting additive proportions to within .01% of batch. Viscosity of finished product will be within ± 2SSU if incoming base stocks are uniform. Infinite flexibility in setting component percentages, with same degree of precision in setting percentage of a small component as of a large component.

4 **Electrical interlocks protect quality of finished product:** Upon failure of any component to reach the machine, all panels will automatically return to "recirculation", cutting off blend manifold. Any shortage is automatically made up so finished product will be on specification at end of run.

5 **Tally meter** throws blender back on "recirculation" after adjustably pre-set batch of finished product is completed.

6 **Warning lights** show panel in use and designate *which* component has failed and *why*.

7 **Automatic blow-back feature** to clear any line or lines is built into each panel.

8 **Mixers** with or without dehydration feature are optional.

9 **All wiring is in explosion-proof conduit** for class 1, Group D hazardous locations.

10 **Construction is unitized:** all base stock and additive panels are of uniform design and can be assembled in any grouping; extra panels can be provided at any time for additional components or increased plant capacity.

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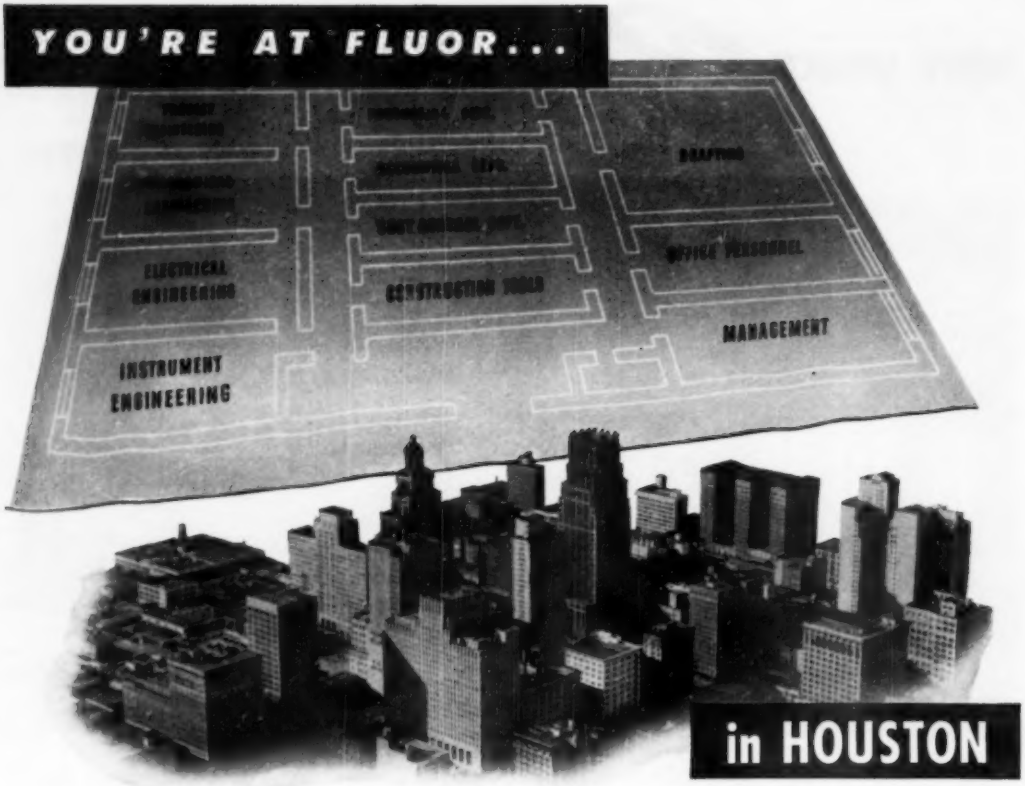

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- Compressor Station addition at Tomball, Texas
- Dehydration Plant at Kopperston, West Virginia
- Hydrogen Sulfide Removal Plant at Corpus Christi, Texas
- Compressor Station at Charleston, West Virginia
- Chemical Specialties Plant near Houston, Texas
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- Compressor Station addition at Philadelphia, Pennsylvania
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Tomorrow
... IN PETROLEUM TECHNOLOGY

BY B. H. WEIL, Atlanta, Ga.
Editor, "Monthly Summary of Industrial Developments"

Brief Reviews of Current Technological and Economic Developments Reported in the Light of Their Possible Effect of Future Petroleum Processing Operations

Economics Changes Plans For Gas Synthesis Plant

THE recent decision of the Standard Oil Co. (Ind.) to abandon plans for a proposed Synthane (Fischer-Tropsch) plant at Garden City, Kan., bears testimony to the influence of economics on technological projects.

For some years, now, it has been generally assumed that synthetic fuels could be produced from natural gas at profitable levels, in competition with petroleum products. This assumption may still be correct, but Standard's subsidiary, the Stanolind Oil & Gas Co., has correctly noted that present market conditions for natural gas, plus future prospects, make it apparent that the sale of gas as such will provide greater profits for this company than through its use in Synthine processing. Accordingly, Stanolind plans to sell the gas from all of its properties in the Hugoton field which would have provided the raw material for the Synthine plant.

This decision has several connotations. First of all, it places upon the Brownsville, Texas, plant of Carthage Hydrocol the full burden of proving the economic feasibility of the synthesis of gasoline from natural gas via the Synthine process. Secondly, it at least postpones a serious threat to the market for many oxygenated hydrocarbons, since the Stanolind plant was to produce large volumes of these compounds as by-products.

The situation, apparently, bears close analogy to the use of residual fuel oils for the production of gasoline via destructive hydrogenation. In times of oversupply of residual fuels, hydrocracking gains favor and attention, only to fade into the background when surplus supplies disappear and prices for fuel oils increase. To date, these varying economics have kept hydrocracking from becoming a major refining process.

Naturally, it is too early to learn whether Standard's decision will influence later decisions by others. Natural gas supplies in remote fields may still have economic attractions for use in Synthine processing. More efficient and less costly synthesis methods are certain to be developed.

However, the price of natural gas will probably continue to be the dominant factor in any decisions concerning the construction of further Synthine plants by private industry. While high prices for natural gas are not looked upon with favor in some quarters, they apparently are having their effect in "saving" this substance for uses more dependent upon its unique physical and chemical properties than as raw material for synthesis into liquid fuels and other products.

Gas Turbines Discussed For Truck Propulsion

W. M. BROWN of the Kenworth Truck Motor Corp., discussing the use of the Boeing Model 502 gas turbine in a Kenworth truck, before the SAE, reported that "1—there is a place for the turbine in highway freight hauling operations, subject to certain limitations; 2—the turbine engine is not yet proven; 3—it has not reached its maximum in performance and development; and 4—it is not yet available for installation, and (we guess) that the cost will not be prohibitive."

As regards gas turbines for all types of installations, Brown listed the following advantages: 1—light weight; 2—small installation space required; 3—few component parts, particularly moving parts ("only ten % as many parts as the average reciprocating engine"); 4—absence of vibration; 5—adaptability to many low-grade, nonexplosive fuels ("octane and cetane numbers do not influence the fuel's usability"), 6—easily maintained, with a minimum of man-hours required to service the engine; 7—good cold weather starting characteristics, once ignition takes place; 8—absence of ignition system, except in starting; 9—maximum fuel economy with maximum engine output; 10—low consumption of lubricating oil; 11—absence of external cooling system; 12—clean exhaust and 13—less objectionable exhaust noise.

"Offsetting the advantages, we have the following disadvantages to consider: 1—higher fuel consumption than piston engines in all ranges, 2—poorest fuel economy in part-throttle operation, 3—high rotative speeds of moving parts, 4—parts most subject to failure are high-cost items, and 5—material for some of the important components is high-cost, hard-to-obtain material."

H. M. Jacklin, Jr., of the Bureau of Ships, Department of the Navy, recently pointed out that the Navy is interested in Boeing's Model 502 gas turbine "for powering small boats because it can operate on aircraft turbine fuels—as well as numerous other liquid petroleum fuels and bottled gas. A Model 502 engine is now being service-tested in a plane-personnel boat. Other possible applications include buses, small airplanes, helicopters, generators, pumps, air compressors, mining equipment, and Arctic vehicles."[1]

National Petroleum News has speculated[2] that wide use of gas-turbine engines in trucks would create new demands for residual and/or Diesel fuels, would add another grade of fuel to be sold at filling stations, reduce the demand for lubricating oils by trucks, reduce antifreeze demands, create new (high-temperature) lubrication problems, etc. Exactly how soon these will become real factors, however, is certainly not clear at this time.

Sonic Agglomeration For Cat-Cracker Effluent

IN THE discussion of a paper[3] on "Sonic Agglomeration of Carbon Black Aerosols," presented at a recent AIChE meeting by C. A. Stokes of Godfrey L. Cabot, Inc., Stokes replied to a question by C. O. McKinney (Standard Oil Co. (Ind.)) as to the upper temperature limit of efficient sonic agglomeration that "it probably is very high. There is no reason why the efficiency of agglomeration, if you can use that term, should not be as good at high temperature as at low except that, of course, in a given smoke, the higher the temperature, the farther apart are the particles.

"At the same time, at the higher temperature the smaller particles are pushed around more by Brownian motion, and I see no reason why your agglomeration shouldn't be good at 1000 or 1500° F. You are probably thinking of a cat-cracker effluent. I think it would work all right. You might find that these particles just don't tend to stick as well as carbon; some materials tend to stick together better than others."

Sonics, or supersonics as one phase of this field is called, are currently receiving much attention for use in many processing steps. The above is but one example of possible use by the petroleum industry.

Gasoline Is Challenged As Bus and Truck Fuel

RECENT papers presented before the Society of Automotive Engineers, at their National West Coast Meeting, Los Angeles, Aug. 14-16, have served somewhat to emphasize the competition with gasoline, as a fuel for trucks and buses, of Diesel fuels and liquefied petroleum gas.

In discussing "The Fundamental Advantages of Diesel Engines for Trucks," S. Glen Shoemaker, of General Motors Corp., stated that "in addition to the most important advantages of power, fuel economy, and fuel cost, there are a number of other features connected with the use of Diesel engines which must be considered as being on the plus side and measurable in dollars." These are: "1—safety of fuel due to absence of explosive vapors, 2—less loss by evaporation and appropriation for private use, 3—nontoxic exhaust, 4—reduced effect of altitude, 5—smaller heat loss to cooling system, and 6—instant response to throttle."

Shoemaker concluded that "at the present state of engine development, the Diesel is well ahead in fuel economy and at least equal in power per cubic inch of displacement. Gasoline engines are limited in power and economy by the octane rating of the fuel. Higher octane means higher priced fuel. Further improvements in the power and economy of Diesel engines are possible with presently available fuels. Diesel fuel is inherently cheaper than gasoline and contains more heat units per gallon. When the millenium arrives and spark ignition engines have high-octane fuels available at the same price as Diesel fuels and can operate at the same compression ratio, the compression engines will still be ahead in fuel consumption by the higher efficiency obtainable at part load with very lean mixtures, and in power by the inherent ability to be supercharged and two-cycled."

LPG is coming in for attention as fuel for buses. In August, the Chicago Transit Authority placed an order for 500 propane-powered buses from the Twin Coach Co., at a unit cost of approximately $16,150. While this figure is said to exceed the cost of gasoline-powered buses by $350 to $500, economies in fuel and operation are expected to eliminate this difference within 25,000 miles of operation. In case of a major war, moreover, it has been pointed out that propane probably would not be rationed, thereby constituting another good reason for purchasing propane-powered equipment.

Not that the manufacturers of gasoline-powered engines for trucks and buses are taking such competition "lying down." At the above mentioned SAE meeting, L. L. Bower of the Waukesha Motor Co., in his paper on "Basic Reasons for Preponderance of Gasoline-Powered Trucks," stated that the cost of gasoline engines are so much less than Diesel engines that "it will require between 50,000 and 65,000 miles per year for the Diesel fuel saving to offset this initial engine cost difference, not to mention any other extra cost items on the Diesel truck."

While the oil companies supply the products that are challenging gasoline as motor fuels, their executives and technologists will watch developments in this field with interest, for they must supply their products in such balance as to meet changing demands of customers.

Acrylonitrile Becoming Big-Volume Petrochemical

ACRYLONITRILE has for some time been of considerable interest to the petroleum industry, since it is a raw material for the GR-N (or Buna-N) type of synthetic rubber, which was developed in this country largely through the activities of petroleum companies who employed butadiene from petroleum sources as the other raw material.

The manufacture of acrylonitrile has itself been of interest to petroleum companies, as mentioned before in this feature.

It is therefore interesting to note a report[4] that the "Carbide & Carbon Chemicals Division has entered into a contract to supply du Pont with substantial quantities of acrylonitrile for expansion of Orlon fiber output. Based on ethylene oxide and hydrogen cyanide, the acrylonitrile will be produced at Institute, W. Va., starting about September, 1951. A large share of the output, of course, will be used by Carbide itself for Dynel, its acrylonitrile-containing synthetic fiber."

American Cyanamid, the only acrylonitrile producer at present, "has a capacity of 28,000,000 lbs. a year, but it is predicted that within 10 years U. S. capacity will increase to 100,000,000 lbs., and perhaps to 300,000,000 lbs. a year." It is reported that the German process for producing acrylonitrile by adding hydrogen cyanide to acetylene "looks good on paper; it has not always been so attractive in actual practice. Du Pont is reported to be operating a pilot plant for the acetylene-hydrogen cyanide process.

"Carbide, on the other hand, might favor the ethylene oxide process since it is a basic producer of this intermediate."[5] Monsanto and possibly Mathieson are also mentioned as "logical entries into the acrylonitrile production field."[6]

All of this activity means the acrylonitrile is advancing into the category of a large-volume "chemical from petroleum." More details of its production and use will be awaited with interest.

Highway Engineers Test Rubber-Asphalt Paving

THE advent of unprocessed natural rubber particles made it possible to secure satisfactory results when mixing rubber with asphalt for paving purposes, and has stimulated test work in this field, Harry K. Fisher, consultant with the Natural Rubber Bureau, Washington, brings out in a recent bulletin.[7] For 12 years paving engineers of the Netherlands and Java have experimented with natural rubber mixed with asphalt paving material in varying percentages. There are said to be 30 experimental stretches of rubber roads in Europe, one a stretch on a heavily traveled road outside of Rotterdam used by both the German and American armies in the war. Natural rubber paving is also being tested in some states in the U. S. and in Canada.

"Results of tests to date" it is stated "indicate that natural rubber added to asphaltic paving material increases the life of the pavement, requires less maintenance, increares the elasticity of the pavement, reduces its susceptibiilty to temperature variations, the pavement is lers brittle at low temperatures, and materially increases the coefficient of friction of the surface area."

The rubber is added to the asphaltic paving material in two ways. One method is to mix it directly with the asphalt prior to mixing the asphalt with the aggregate. The second, considered preferable, is to add the rubber to the aggregate just after the aggregate enters the mixing chamber of the asphalt plant and prior to the introduction of the asphalt to the mix. No difficulties have been reported in mixing, laying or rolling the rubber-asphalt paving materials.

In correspondence with the author of the bulletin, it was brought out that synthetic rubber has been tried in the place of natural rubber, in road surfacing, but that it will not duplicate the results with natural rubber. "It was natural rubber powder of a particular type (same as we are using)," stated the author, "which was used by the Dutch engineers in their paving experiments which performed so outstandingly that it attracted the attention of the world."

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(2) Anon., *National Petroleum News*, 42 No. 34, 46 (1950).

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(4) Anon., "Newsletter," *Chemical Industries*, 67, No. 2, 171 (1950).

(5) E. H. Riddle, "Aliphatic Chemicals," *Chemical Industries*, 67, No. 2, 188, 189 (1950).

(6) Anon., "ConCENtrates—Acrylonitrile's Future," *Chemical and Engineering News*, 28, No. 33, 2749, 2750 (1950).

(7) "Stretching Highway Dollars with Rubber," by H. K. Fischer, Rubber Road Consultant, Natural Rubber Bureau, Washington, D. C.

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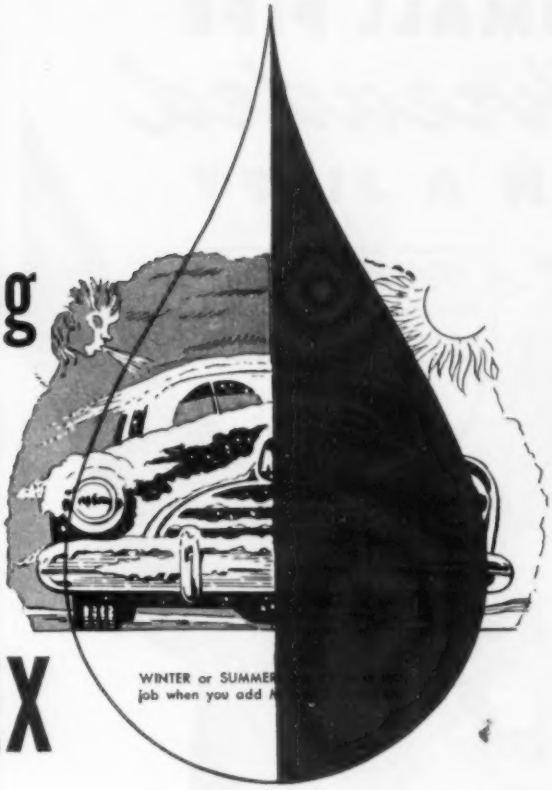

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Letters . . .

Refinery Expansion

I like your 7.5 Billion Dollar article [on refinery expansion, Sept. PP, p. 933] very much, particularly in a couple of places.

I do not quite reconcile the title which says "$7.5 Billion Expansion Program" with Table 5, which shows a $3.1 billion expansion program with a $4.4 billion replacement program. The 7.5 appears to be the construction forecast rather than the expansion forecast. Of course, it is understood that when one gets to tossing billions around one is apt to be expansive.

I believe your estimate of new facilities is on sound ground. The estimate of 4.4 billion for replacement may be high since present day costs have a tendency to make the most progressive Boards of Directors hesitate to replace a piece of capital goods before the last quantum of usefulness has been squeezed from it.

On the other hand, the forces of competition require the refiner to modernize in order to stay in the octane race. Then, too, there may be excess profits taxes which will influence the construction program.

I think you have handled the subject in a competent manner. If other people disagree, time will tell whose eye is the blackest.

W. T. GUNN
Director
Division of Refining
American Petroleum Institute
New York, N. Y.

● . . . I think you did an excellent job on this, but there are a few points I would like to comment upon.

1. I am inclined to disagree with Dr. Gonzales in his expectations of a decreased ratio "for the long term" of liquid to solid fuels. This ratio has been increasing at an accelerating rate, and I believe it will continue to increase as long as liquid fuel is available for importation.

2. You state that catalytic cracking not only increases octane number, but also increases total gasoline yield. This statement has appeared a number of times, but I believe it is not correct. The reason the increased yields *seem* to be true is that the conventional catalytic cracking installation includes certain other elements which are not normally included in thermal cracking installations.

However, a careful study was made here a few months ago covering a wide variety of cases. In some cases a naphtha reforming step was included. In all cases, naphtha polyforming and catalytic polymerization steps were included. Atmospheric and vacuum distillation was compared with atmospheric topping; thermal

cracking was variously applied to distillate, residual and catalytic cycle stocks; catalytic cracking was employed with conversions ranging from 55 to 74%.

The study indicated that processing schemes involving catalytic cracking gave about the same yields of motor fuel as those involving thermal cracking. In most cases the thermal cracking had slightly higher yields. The study also indicated that it would cost the petroleum industry between $4 and $5 billion capital investment to arrive at the complete substitution of catalytic for thermal cracking.

3. I do not doubt that there will continue to be an upward trend in octane number, but a number of factors are acting as powerful deterrents to this trend. One factor is the excessively high cost of additional octane numbers. Another factor is the present war situation which may have, of course, a profound effect on the course of petroleum refining during the next 10 years. Still another factor is the progress being made by automotive engineers on engine design.

EUGENE AYRES
Technical Assistant
to Exec. Vice President
Gulf Research & Development Co.
Pittsburgh, Pa.

• Although each refiner will probably attack this problem somewhat differently according to his own requirements, the ultimate expansion will probably boil down to about the end conclusions you have reached. In general, we feel that your article presents a very good forecast of what is ahead of us in refinery expansion.

T. B. KIMBALL
Sinclair Refining Co.
New York, N. Y.

• I am in agreement with your prediction that substantial additions must be made to the refining capacity in the United States in order to meet the estimated demands for petroleum products during the next ten years. Of course, any prediction of this kind must be based on a forecast of the domestic demand for petroleum products and this is true whether we are predicting refining capacity or the need for synthetic fuels. For this reason, I am especially interested in your forecast that domestic demand will equal 8,500,000 barrels per day by 1960.

. . . [without] any desire to criticize a forecast, I would like to comment a little on the reasons for forecasting a somewhat lower demand at that time.

In making forecasts of this kind we have attempted to avoid the use of a compound interest curve, especially when making forecasts running to 1975, because the history of most industries seems to indicate that a Pearl-Reed or Gompertz type of

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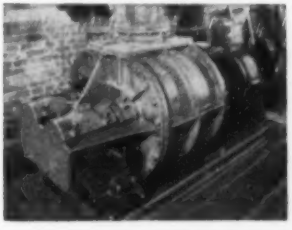

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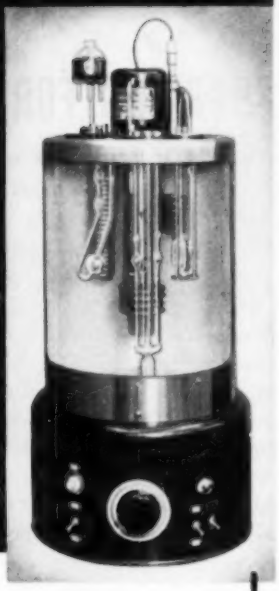

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Letters . . .

curve is more typical of the growth and decay of industries. A compound interest type of curve tends to increase more and more each year, whereas it may be expected that sometime in the future the demand will tend to level off. For example, railroads may have already reached their maximum requirements for petroleum fuels, and [it may be] that as time goes on and more and more lines are dieselized, the total demand for petroleum products will become less. Also, it is doubtful if tractor fuels can continue to increase indefinitely since we should fairly soon reach the saturation point for tractors in the United States.

When Dr. Gonzales presented his paper before the American Petroleum Institute in Chicago we compared his forecast with ours and, basing the increase on 1949 domestic demand, found that his demand figure was approximately 8,000,000 barrels per day, substantially in agreement with our estimate of 7,900,000 barrels.

As you know, looking into the future and trying to predict the demand for petroleum products is most difficult and I am quite amazed and pleased that our estimates of requirements ten years in the future are as closely in agreement as they are.

A. L. SOLLIDAY
Executive Vice President
Stanolind Oil & Gas Co.
Tulsa, Okla.

Standardization

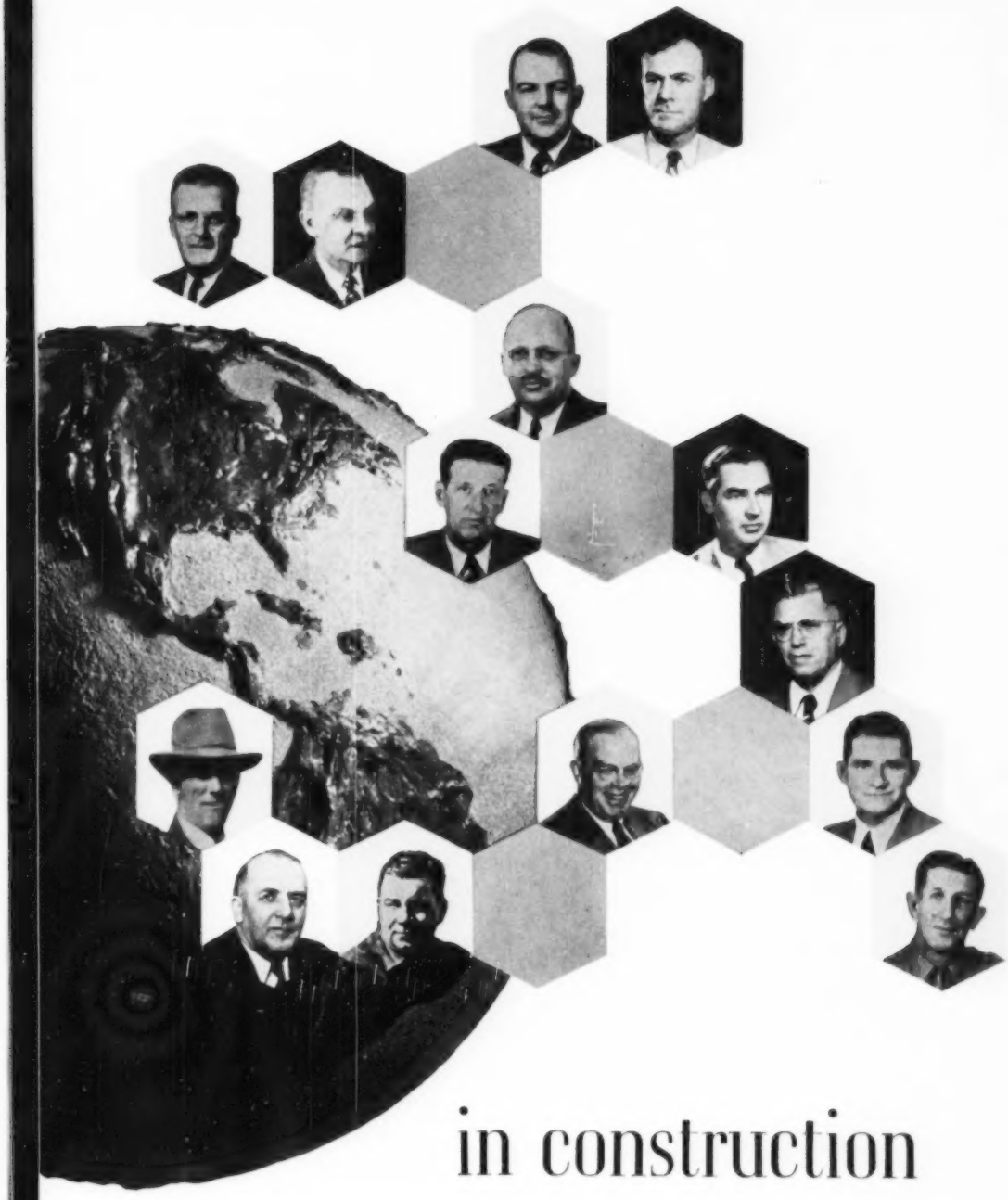
I appreciate very much your editorial [Sept. PP, p. 1012] concerning the oil measurement standardization work we are doing. We feel this work is of the utmost importance and fills a need which has existed for 50 years in the industry.

Even a small amount of investigation will show that only a few codes have been prepared on oil measurement, and these are scattered between several industry associations and none is complete or up-to-date. Even licensed inspection firms disagree as to how oil should be measured and tanks calibrated. Most major oil companies have prepared their own oil measurement manuals and standards because of the uncertainty prevailing as to what is the best procedure and equipment.

I contend that it is entirely inconsistent and very poor policy for oil company management to carefully check all accounts to the nearest penny but devote little attention to the fact that a cargo of product may be measured with an accuracy of no better than $500 worth of product.

The ASTM work aims to produce standards representing the best practices and equipment used today and fills many voids where no standards or codes of any type are available.

L. C. BURROUGHS
Shell Oil Co.
New York, N. Y.



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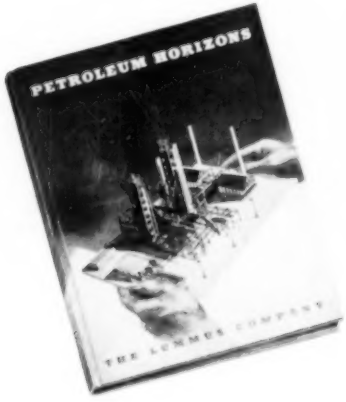

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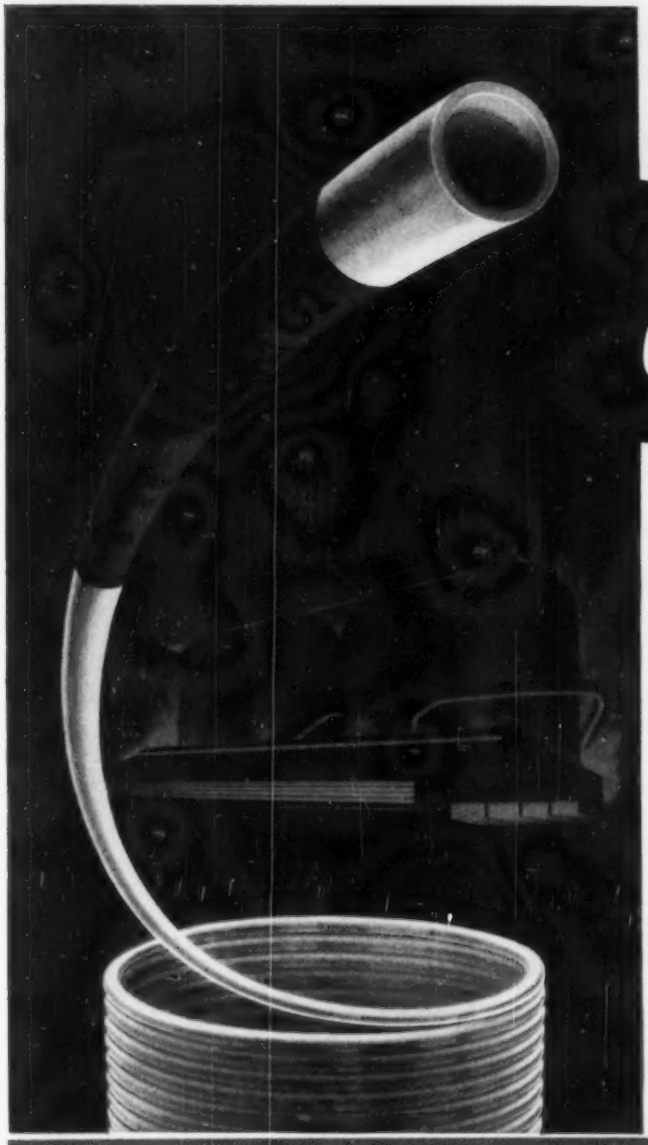

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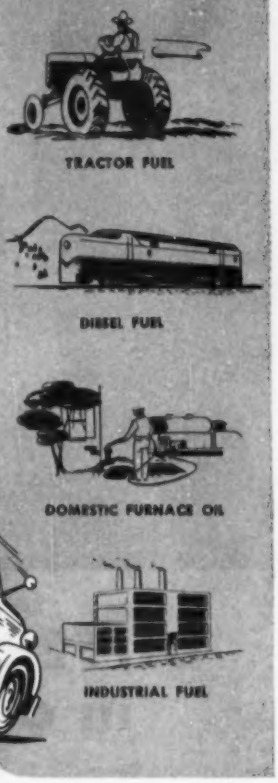

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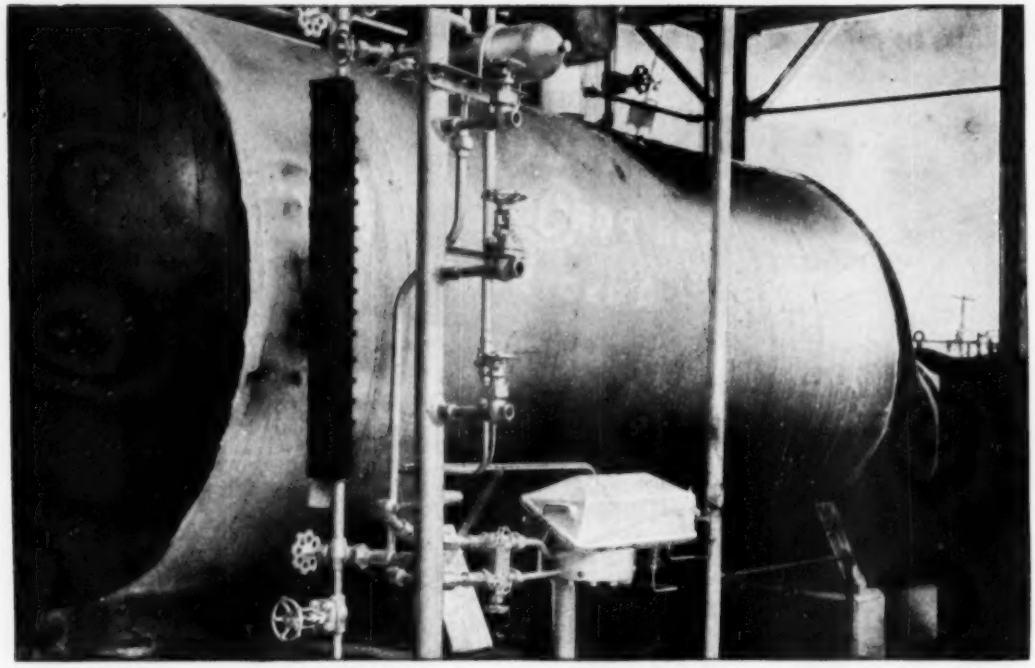

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SENSITIVITY — Due to the negligible motions required for complete operation of all parts for full scale changes, no appreciable hysteresis results from reversal of direction of measurement change. The hysteresis loop is so small that it is undetectable by ordinary means, being less than 1/20 of 1%.

ACCURACY — The accuracy of the Republic force-balance method of measurement is higher than can be consistently secured and maintained with any other method. Transmitting pressure vs. measured force is guaranteed within ½ of 1% of meter range.

In addition to these five important features, the Republic Pneumatic Transmitter is extremely flexible in application, easy to service and of rugged construction.

If you have a flow, level, pressure or liquid density metering or control problem may we suggest that you investigate the Republic Pneumatic Transmitter? Data Book No. 1002, which contains complete details of this instrument, will be mailed to you upon request. Write for it today!

REPUBLIC FLOW METERS CO.

2240 Diversey Parkway, Chicago 47, Illinois

- Sizes ½ to 6⅝ inches O.D.
- Wall Thickness .083 to 1.000 inches.
- Analyses—To Meet Conditions Where Heat, Corrosion, Pressure and Structural Strength are Involved.

Do the job best with the best tubing for the job—get

GLOBE

ALLOY STEEL TUBES

SEAMLESS—MECHANICAL—PRESSURE

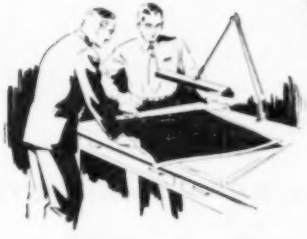
TYPICAL ANALYSES:

- Carbon Moly
- 1¼% Chrome ½% Moly .50/1.00
- 1¾% Chrome .60/.80 Moly
- 2% Chrome ½% Moly
- 2¼% Chrome .90/1.00% Moly
- 4/6% Chrome ½% Moly
- 6-8% Chrome ½% Moly
- 7-9% Chrome ½% Moly
- SAE 1335
- SAE 2300
- SAE 2512
- SAE 4130; SAE 4140
- SAE 4615
- SAE 8615, 8617 Fine Grain
- SAE 8620; 8630; 8635; 8640
- 5% Ni.
- 9% Ni.

TYPICAL APPLICATIONS:

- Superheat Tubes
- Pressure Tubes
- Still Tubes
- Mechanical Tubes
- Condenser Tubes
- Barrel Tubes
- Pump Barrels — Oil Well
- Evaporator Tubes
- Aircraft Tubes
- Propellers
- Rollers for Transmission Chains
- Oil Well Tubing

GLOBE TUBES



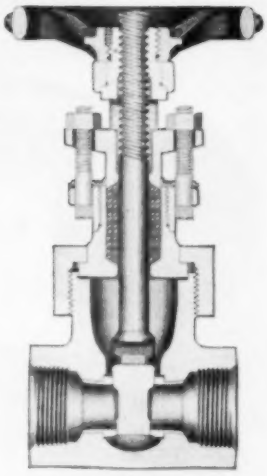
Globe engineers gladly give you the benefit of specialized knowledge and experience on the application of steel tubing in a wide range of services — mechanical — pressure — corrosion resistant.

GLOBE STEEL TUBES CO., Milwaukee 4, Wis.

Chicago - Minneapolis - Cleveland - Detroit - New York - Philadelphia
St. Louis - Tulsa - Houston - Denver - San Francisco - Glendale, Calif.

Producers of Globe Seamless Stainless Steel Tubes — Gloweld Welded Stainless Steel Tubes — Carbon-Alloy-Seamless Steel Tubes — Globeiron Seamless High Purity Ingot Iron Tubes — Globe Welding Fittings.

Big help to any standardization plan ...the complete CRANE line



No. 3602X, 600-Pound Small Steel Gate for oil or oil vapor up to 1100° F. Exalloy to Exalloy seating. Sizes: ¼ to 2-inch. Screwed or welding ends.

MODERATELY PRICED SMALL STEEL VALVES

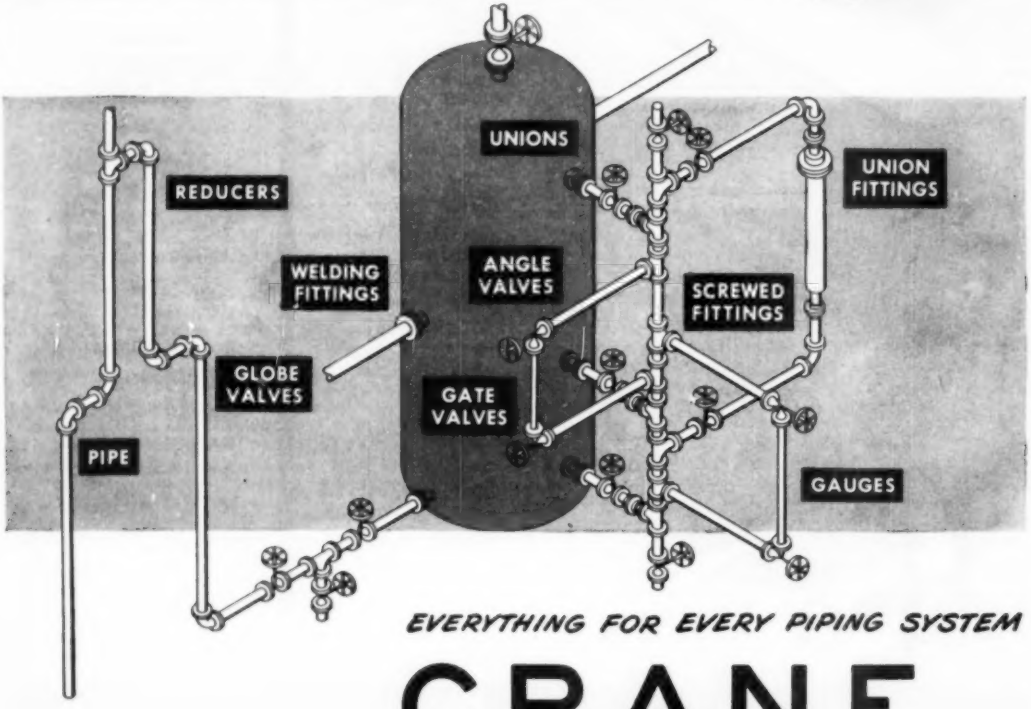
Why moderately priced? Because of Crane Co.'s better facilities for *quality* mass production. Designed to withstand tough services, Crane Small Steel Gates provide extra strength and safety under piping and pressure strains, and extreme temperature variations.

These rugged, compact valves are easy to service . . . easy to operate. Husky union bonnet ring with long thread engagement pulls up easily, stays tight, protects against distortion when valve is opened. T-head disc-stem connection gives flexibility for smooth operation. Fully guided solid wedge disc cannot get out of line, drag on seating surfaces, or jam in body.

Little routine maintenance required. Deep stuffing box with one-piece gland and gland flange assures tight stem seal. Outside screw and yoke construction keeps stem threads out of contact with line fluids, simplifies lubrication. See your No. 49 Crane Catalog, or write for Circular AD-1741.

CRANE CO., 836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

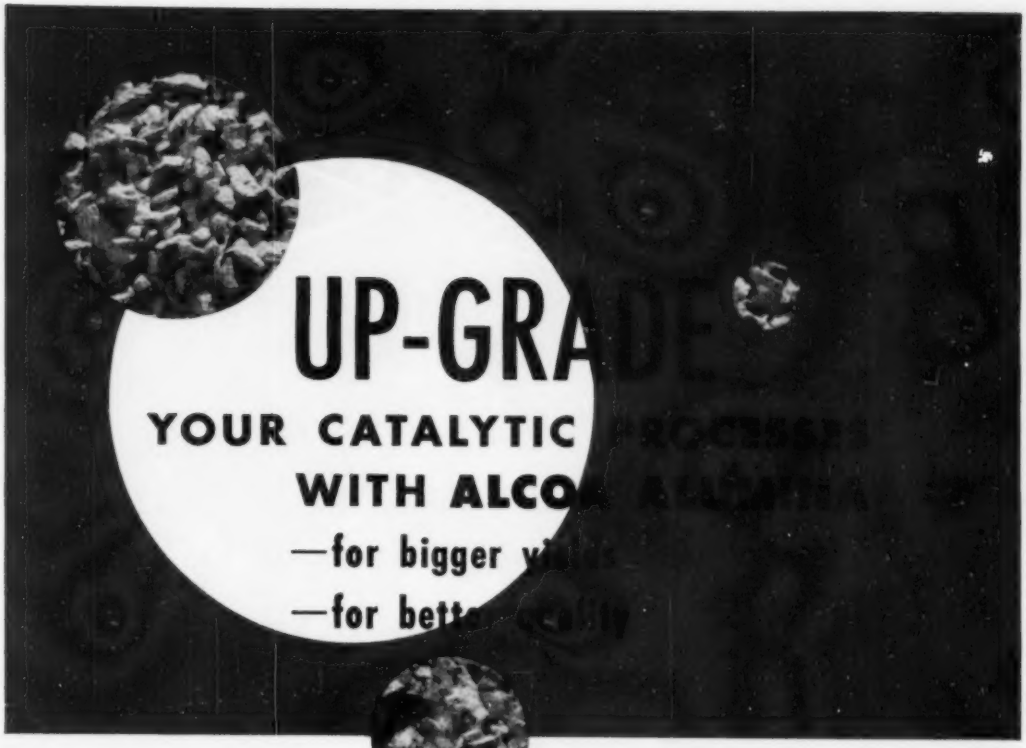
ONE ORDER TO CRANE COVERS ALL PIPING NEEDED FOR THIS GAUGE GLASS HOOK-UP, FOR EXAMPLE



EVERYTHING FOR EVERY PIPING SYSTEM

CRANE

VALVES • FITTINGS • PIPE • PLUMBING AND HEATING



If you want to up-grade your catalytic process yields, or simply reduce losses from contamination and side reactions, you'll find it advantageous to insist on ALCOA Aluminas for your Al_2O_3 catalysts and catalyst supports.

ALCOA Aluminas are uniform in structure and chemical purity . . . stable at elevated temperatures . . . have high resistance to erosion and crushing . . . and are moderate in cost. Typical conversions for which ALCOA Aluminas are used include: *Aliphatic hydrocarbons into aromatics, and dehydrogenation of naphthenic hydrocarbons.*

★ **ALCOA *Activated* Alumina is preferred for many reactions because of its high adsorptive properties and extremely large surface area.**

★ **ALCOA *Tabular* and other forms of Alumina are preferred for certain reactions where hardness and extremely high purity are relatively more important than maximum surface area.**

For top quality, specify ALCOA Aluminas for catalysts and catalyst supports. You'll get more efficient, uniform reactions and end-products of higher purity. We'll gladly send you samples and further information.

Write to
ALUMINUM COMPANY OF AMERICA
CHEMICALS DIVISION
616K Gulf Building
Pittsburgh 19, Pennsylvania

Alcoa Chemicals

ALCOA ALUMINUM

ALUMINAS and FLUORIDES

ACTIVATED ALUMINAS · CALCINED ALUMINAS · HYDRATED ALUMINAS · TABULAR ALUMINAS · LOW SODA ALUMINAS
ALUMINUM FLUORIDE · SODIUM FLUORIDE · SODIUM ACID FLUORIDE · FLUOBORIC ACID · CRYOLITE · GALLIUM

[To obtain more data on advertised products see page 1116]

The staff of REFINERY ENGINEERING Company thought a refinery need not be just a jungle of pipes and valves and vessels. It could be as appealing as other manufacturing plants, and should have something to attract the favorable attention of the public.

With this in mind, Treco engineers designed the first refinery with "picture windows". The control room was placed as near as possible to a main highway.

Large areas of plate glass permitted the public to look in and the public has been looking into this nerve center of operations—in extraordinary numbers. This has proven to be such an important public relations gesture that you will see more progressive refiners adopting it. Treco will announce others soon.

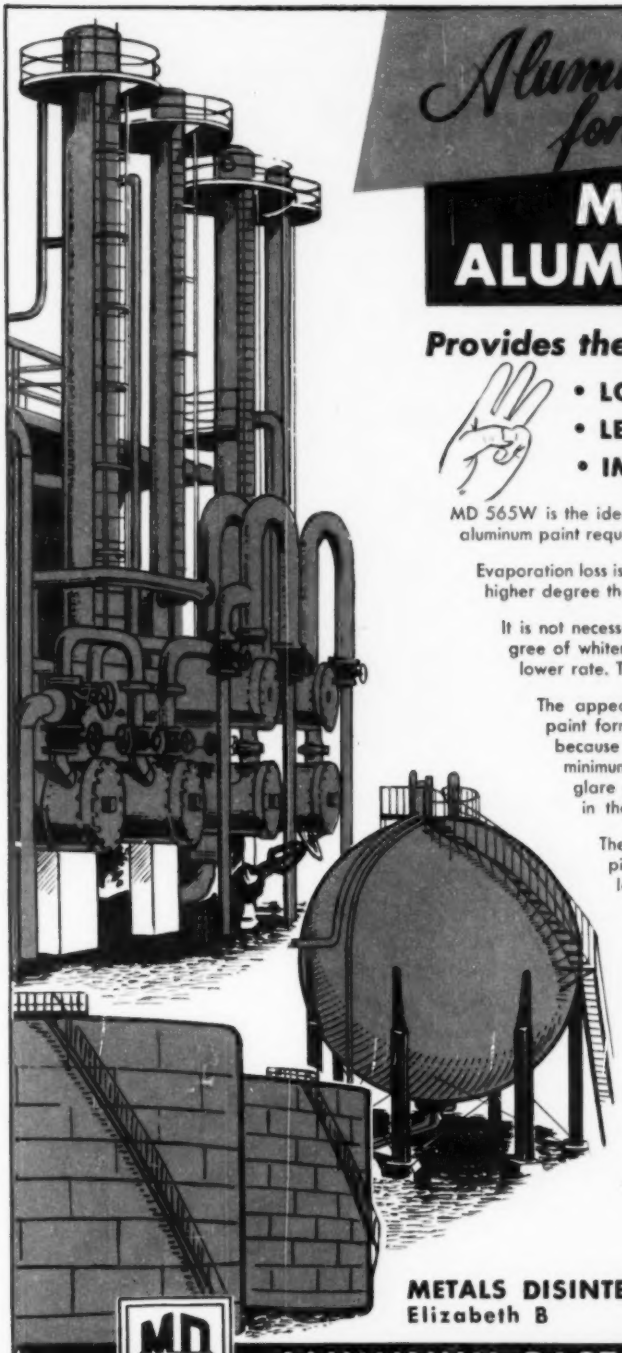
Show the public the "inside workings" of your business. Let people know how your product is made. Show them a modern, clean and highly efficient plant and you will gain their loyalty. And, get in touch with REFINERY ENGINEERING Company right away, for information on how your plant can be improved to do a better production as well as a better public relations job.

TRECO

TELEPHONE
WIRE or WRITE

REFINERY ENGINEERING *Company*

PHONE 5-5561 • TULSA, OKLAHOMA



Aluminum Paint formulated with–

MD 565W ALUMINUM PASTE

Provides these 3 big advantages–

- **LOWER EVAPORATION LOSS**
- **LESS FREQUENT PAINTING**
- **IMPROVED APPEARANCE**

MD 565W is the ideal all-purpose pigment for the formulation of aluminum paint required for petroleum equipment.

Evaporation loss is greatly reduced, because it reflects heat to a higher degree than standard paste pigments.

It is not necessary to paint so often. Due to the greater degree of whiteness in MD 565W, color change is at a much lower rate. This results in reduced maintenance costs.

The appearance of equipment painted with aluminum paint formulated with MD 565W is greatly improved, because it produces a whiter, brighter finish with a minimum of highlighting and spotty glare. Its non-glare characteristics are particularly advantageous in the painting of large surfaces, such as tanks.

These and many other features make this new pigment a fast increasing favorite for petroleum industry use.

To assure these advantages in your aluminum painting, specify that MD 565W be used in the formulation of the ready-mixed aluminum paint you purchase, or in those paints which you formulate.

Send For–

your copy of bulletin "Reflectivity of Aluminum Flake Pigments"

METALS DISINTEGRATING COMPANY, INC.

Elizabeth B • New Jersey

MD POWDERS Since 1916

ALUMINUM PASTES
ALUMINUM POWDERS
GOLD BRONZE POWDERS

Aiming for higher octanes?

See how THIS Mercaptan Removal Process replaces doctor treating AND

- *reduces TEL requirements*
- *gives you low operating costs*
- *requires a minimum of new equipment*

More than seven years of commercial refinery operation have proved conclusively the high efficiency of the Tannin Solutizer Process* for mercaptan removal. This is the process that brings your equipment up to "new plant" standards in the economical treatment and blending of higher octane gasolines, *without* affecting the stability of the treated product.

Converting to the Tannin Solutizer Process requires a minimum investment in new equipment . . . very likely your present equipment will serve with little change.

Operating economy is an outstanding advantage of the Tannin Solutizer Process. Still another important consideration . . . *this process is not corrosive;* does *not* require equipment of special alloys.

Complete engineering service is available . . . to help plan your unit, to supervise start-up, to assist in later operation if required. We welcome the opportunity to work with you in achieving the many benefits of the Tannin Solutizer Process.

**The Tannin Solutizer Process is licensed under the patent rights of Socony-Vacuum Oil Company and Shell Development Company.*

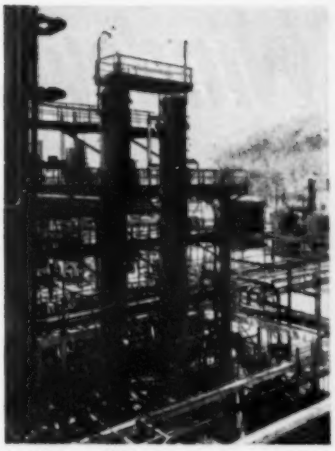
SHELL DEVELOPMENT COMPANY
50 West 50th Street, New York 20, New York

SHELL

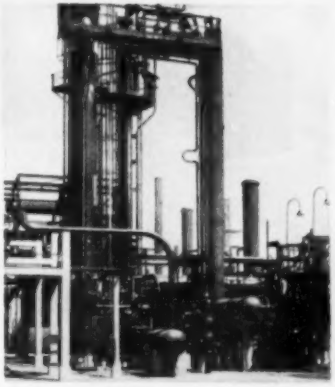
(To obtain more data on advertised products see page 1116)

Chemical Plant...Texas

Works speak louder than words



Refinery...Ohio



Refinery...Illinois

Chemical Plant...Arkansas

They all use **Girdler GIRBOTOL Plants** to remove acid gases

YOU CAN COUNT on Girdler's wide experience in building GIRBOTOL plants to keep right on growing. For the GIRBOTOL process is the *most economical method known* for removing acid gases, such as hydrogen sulphide and carbon dioxide from gas mixtures. More and more companies are proving that to their own satisfaction with operating data from their GIRBOTOL plants.

The GIRBOTOL Process is the *accepted* process for purifying gaseous refinery hydrocarbons. And more than a score of GIRBOTOL plants are being used to remove hydrogen sulphide from liquid hydrocarbons such as butane, propane, polyfeed stocks, straight-run naphthas and gasoline.

You'll find the GIRBOTOL Process not only the lowest cost method of hydrocarbon purification, but it may also be a source of valuable by-product hydrogen sulphide, used to produce elemental sulphur.

You can obtain technical help from Girdler on problems involving the manufacture, purification, separation, or utilization of industrial gases. Call or write us now.

GAS PROCESSES DIVISION

THE GIRDLER CORPORATION

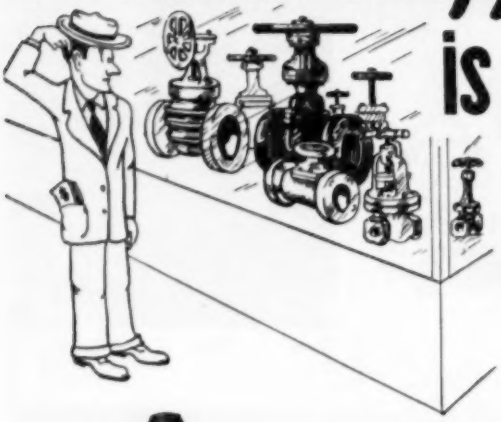
LOUISVILLE 1, KENTUCKY

DISTRICT OFFICES:
150 Broadway, New York City 7
2612 Russ Bldg., San Francisco 4
311 Tulsa Bldg., Tulsa 3

DESIGNERS, ENGINEERS AND CONSTRUCTORS

[*To obtain more data on advertised products see page* 1116]

"Window Shopping" for Valves is poor economy



Reading advertisements is like "window shopping"—it's a good way to see what's on the market. But don't let it influence you into buying your flow control equipment from different sources.

Because if you buy all your valves from one source you avoid these pitfalls:

Complications in stocking spare valve parts.

Difficulties that confront the maintenance department in making repairs on a variety of valves.

The necessity of carrying a much larger stock of repair parts.

The chances of installing valves that are not backed by adequate engineering service.

By offering the *only* COMPLETE line of valves available to Industry today, Powell makes this possible. And if you consult Powell Engineers and select the right valve to suit each individual service, your flow control problems are ended.

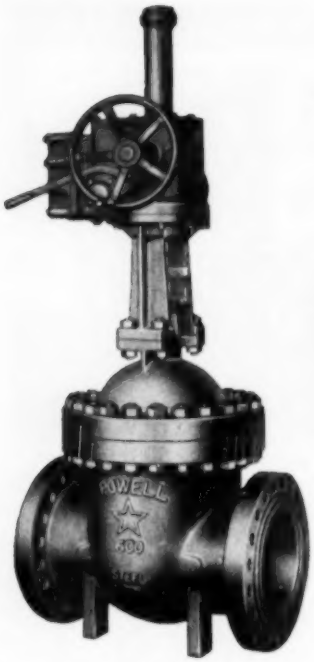


Fig. 6079 M.O.—Class 600-pound Cast Steel Gate Valve for Pipe Line Service. Has flanged ends and bolted flanged bonnet. Motor operated. Also available in Classes 150, 300, and 400 pounds.

Fig. 375—200-pound Bronze Gate Valve. Screwed ends, union bonnet, inside screw rising stem and renewable "Powellium" wear-resisting nickel-bronze disc.

Fig. 1561—Class 150-pound Cast Steel Swing Check Valve with flanged ends and bolted cap.

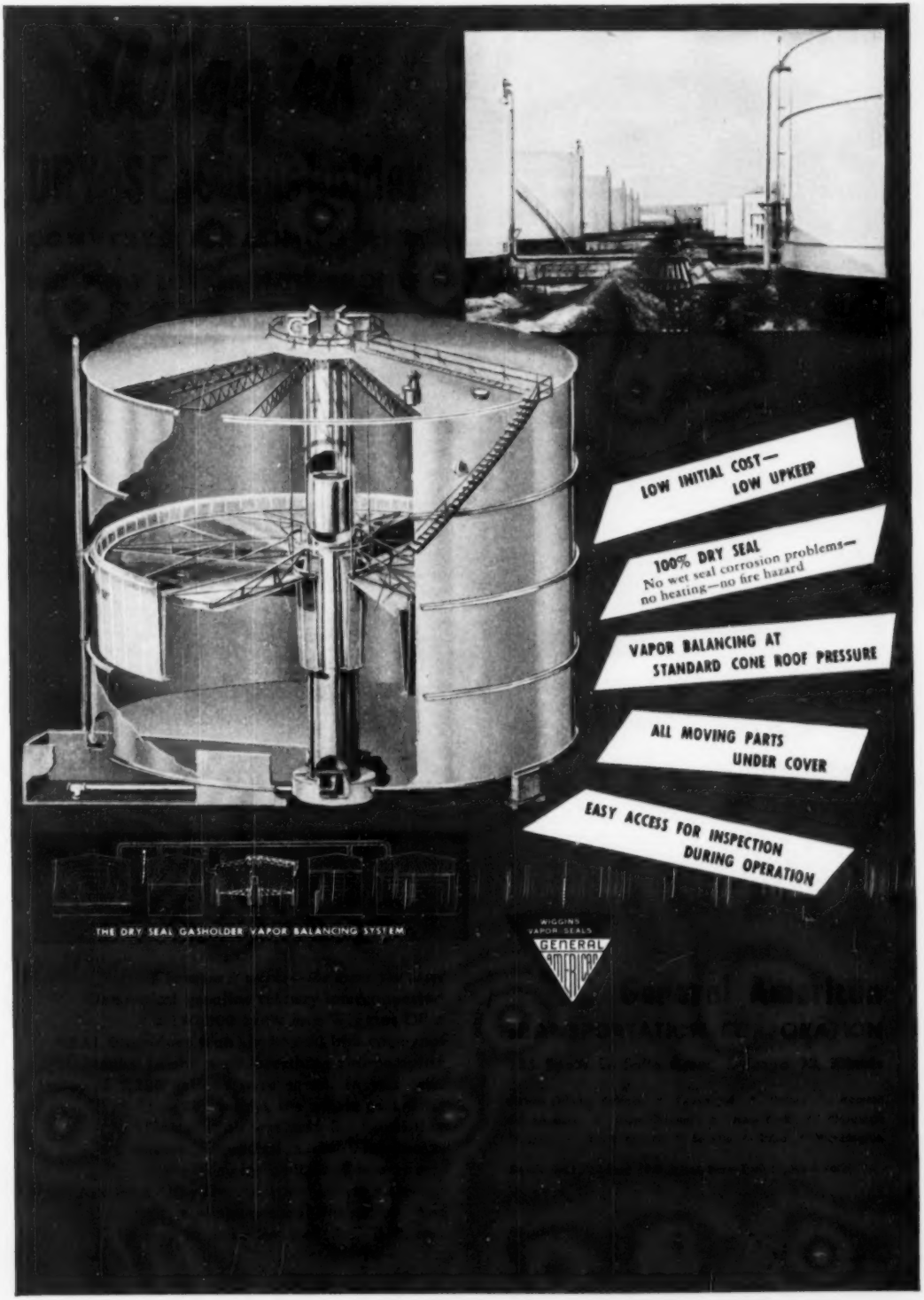
Fig. 1793—Large 125-pound Iron Body Bronze Mounted Gate Valve with flanged ends, bolted flanged yoke, outside screw rising stem and tapered solid wedge. Also available in All Iron.

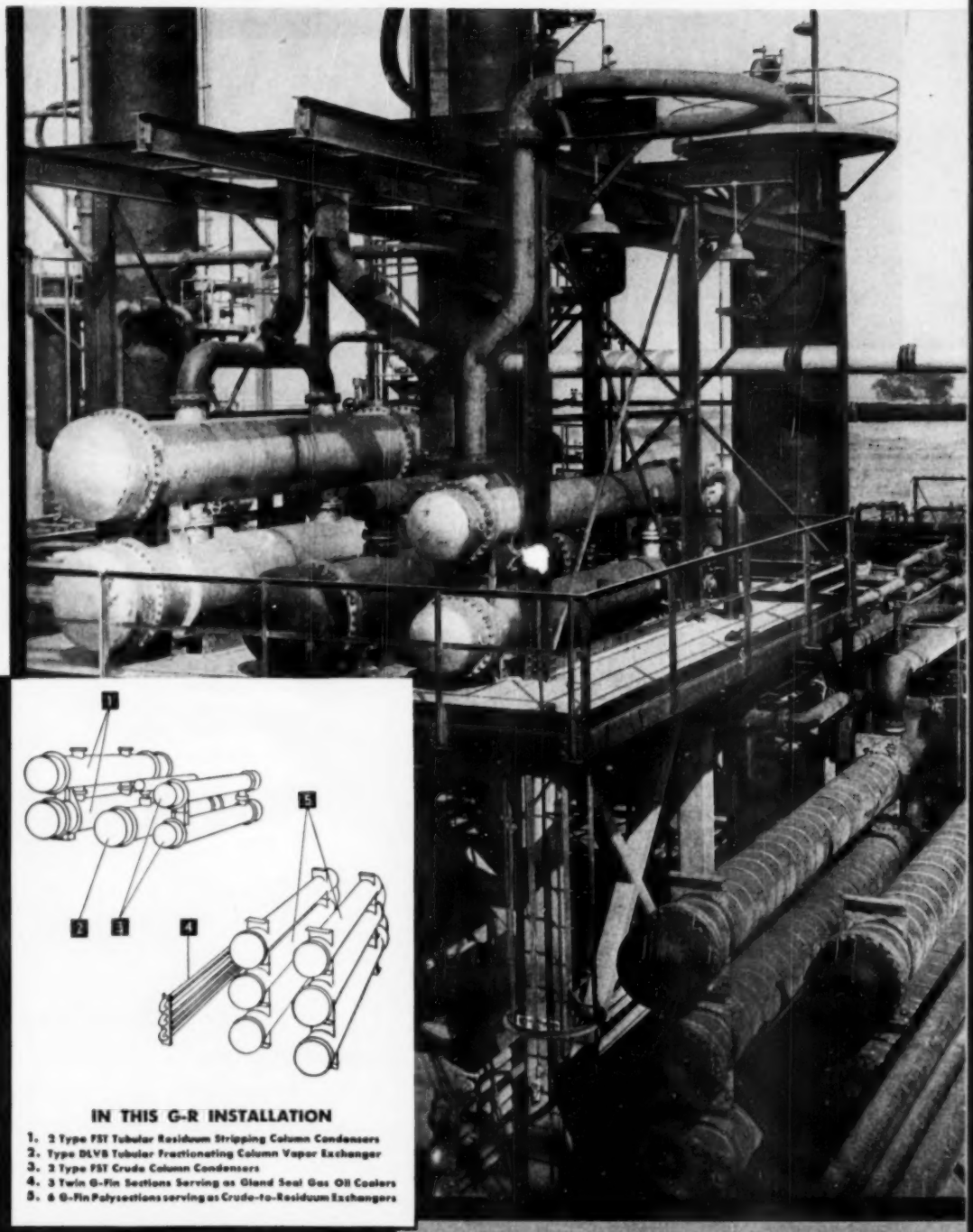
The Complete Powell Line includes Globe, Angle, "Y", Gate, Check, Non-return, Relief and Flush Bottom Tank Valves in Bronze, Iron, Steel and a wide range of Corrosion-resistant metals and alloys.

Ask your nearest Distributor—or write direct

The WM. POWELL Co., 2525 Spring Grove Ave.
P. O. Box 106, Station B, Cincinnati 22, Ohio
DISTRIBUTORS AND STOCKS IN ALL PRINCIPAL CITIES

POWELL VALVES


LOW INITIAL COST—
LOW UPKEEP
100% DRY SEAL
No wet seal corrosion problems—
no heating—no fire hazard
VAPOR BALANCING AT
STANDARD CONE ROOF PRESSURE
ALL MOVING PARTS
UNDER COVER
EASY ACCESS FOR INSPECTION
DURING OPERATION
THE DRY SEAL GASHOLDER VAPOR BALANCING SYSTEM
WIGGINS
VAPOR SEALS
GENERAL
AMERICAN



IN THIS G-R INSTALLATION

1. 2 Type FST Tubular Residuum Stripping Column Condensers
2. Type DLVB Tubular Fractionating Column Vapor Exchanger
3. 2 Type FST Crude Column Condensers
4. 3 Twin G-Fin Sections Serving as Gland Seal Gas Oil Coolers
5. 6 G-Fin Polysections serving as Crude-to-Residuum Exchangers

GRISCOM-RUSSELL: PIONEERS IN HEAT TRANSFER APPARATUS

Meet this G-R family group of HEAT TRANSFER APPARATUS

In the illustration on the adjoining page, you will find some of the large family of G-R heat transfer apparatus. This particular group includes finned tube and bare tube units . . . condensers, heat exchangers, and coolers.

Many additional G-R units, not shown in the illustration, and including condensers, heaters, coolers, subcoolers, reboilers, and heat exchangers on a great variety of services were also furnished for this representative plant.

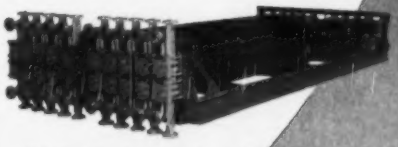
Throughout the petroleum industry in the United States and abroad, in refineries, natural gas and gasoline plants, and in pipe line pumping stations, G-R heat transfer apparatus has made records of effectiveness, economy, and durability on standard and special services. To assure best results in your heat transfer operations, standardize on G-R apparatus.

THE GRISCOM-RUSSELL CO.
285 Madison Avenue, New York 17, N. Y.

SOME STANDARD DESIGNS OF G-R HEAT EXCHANGERS

G-R Twin G-Fin Section — with finned type heat transfer elements that compensate for the unequal heat transfer rates of fluids of high and low heat conductivity.

G-R Tubular Exchanger — with several distinctive features that provide most effective heat transfer and minimum maintenance expense.



G-R Tubeflo Section — the only design of heat transfer apparatus that maintains rated capacity with clogging or dirty fluids.

GRISCOM-RUSSELL

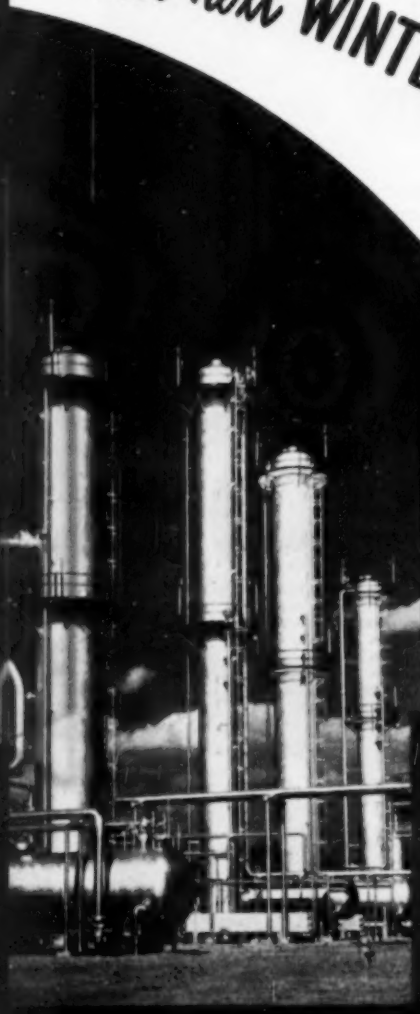
meet next WINTER'S need for POWER and SPEED

USE **WARREN'S** *Stabilized*

NATURAL GASOLINE OR STA-VOL-ENE

When winter comes, city streets, highways or country roads . . . all forms of Transportation, Industry and Agriculture . . . will again be confronted with the common problem—greater traffic difficulties. When temperatures are low and motors are cold and slow, airways, highways and waterways are rough and tough—harder to negotiate.

But . . . traffic, industry and agriculture may be adjusted to weather conditions. The answer is modern, quick-starting, carbon-free, smooth-accelerating, high octane motor fuel . . . obtained by blending refinery run gasoline with Warren's dependable Stabilized Natural Gasoline and Butane, that have fine lead susceptibility.



NATURAL GASOLINE
Butane
Propane
Iso-Butane
Iso-Pentane
Hexane
Heptane
STA-VOL-ENE

WARREN PETROLEUM CORPORATION

Producers, Manufacturers, Exporters and Marketers

Export Terminals, Corpus Christi, Port Arthur, Baytown, Texas City, and Norsworthy, Houston, Texas.

TULSA 2, OKLAHOMA CABLE ADDRESSES: Stavolene, Warren

Crude Oil, Natural Gasoline and Liquefied Petroleum Products

cooling tower fans?

here's a REAL Recommendation!

where the Hartzite cooling tower fan has been tried it has been specified regularly on following towers by the same user

Except in cases of obvious abuse, *not one* Hartzite plastic fan has ever failed. And thousands of them have been installed.

Where there is a battery of towers, one Hartzite fan goes in, then the other towers are Hartzite equipped as replacement becomes necessary. That's the established pattern.

Practically all the leading cooling tower builders specify this fan—many of them exclusively.

Extremely resistant to shock and vibration damage; practically impervious to weathering and the acids and alkalies found in oil refining; stands up well against abrasion.

Hartzell cooling tower fans of 3′ to 10′ diameter are aluminum; from 10′ to 22′, Hartzite plastic. For *dependable*, month-after-month economy and safety, *insist* on Hartzell cooling tower fans. Write —or mail the coupon below—now.

HARTZELL

PROPELLER FAN CO.

DIV. OF CASTLE HILLS CORP.

PIQUA, DEPT. K OHIO

Clip and mail now

Send Hartzell Cooling Tower Bulletin 1502

Name_____

Company_____

Street & No._____

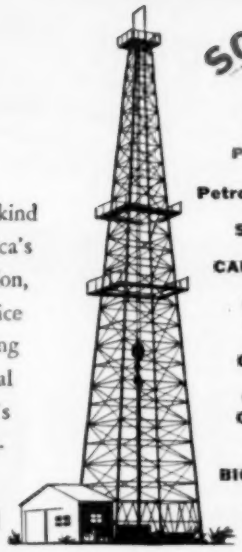
City & State_____

PROPELLER-TYPE FANS AND BLOWERS—ROOF VENTILATORS—UNIT HEATERS • ENGINEERING OFFICES IN PRINCIPAL CITIES

When You Specify **SOLVAY** *Products for Petroleum* . . .

. . . you get the ultimate in quality—the kind of quality you would expect from America's leading producer of alkalies. But in addition, you get the fast, dependable delivery service which can only come from a company having more than one plant . . . and over 200 local stock points from coast to coast. Solvay's exclusive Technical Service is also available at your request.

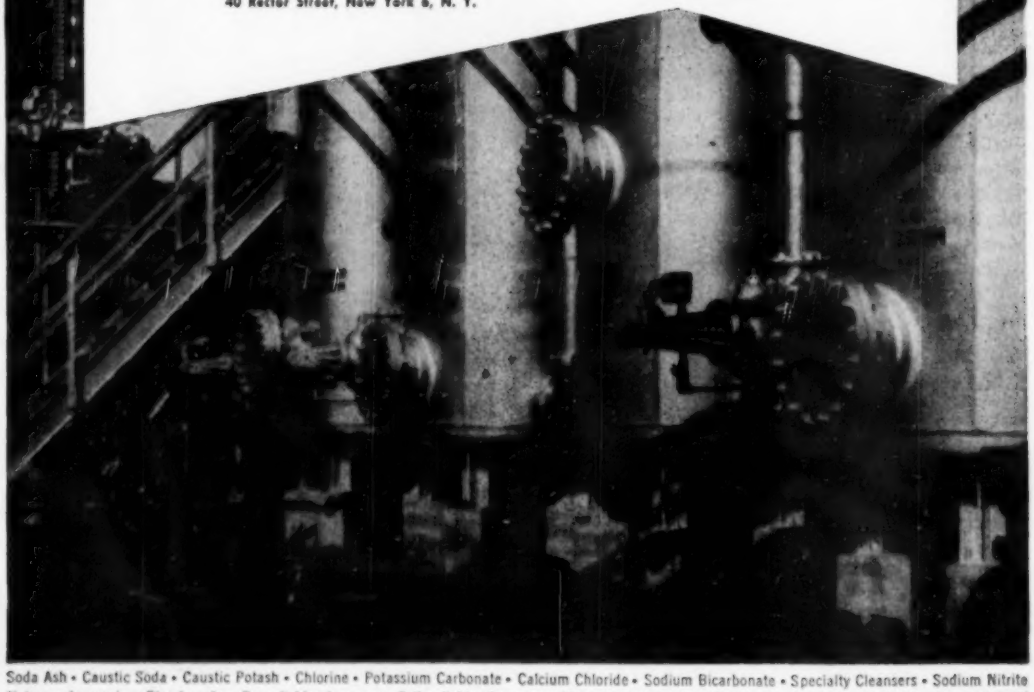
SOLVAY SALES DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street, New York 6, N. Y.



SOLVAY

PRODUCTS for the Petroleum Industry

SODA ASH
CAUSTIC SODA
CAUSTIC POTASH
CHLORINE
CALCIUM CHLORIDE
SODIUM BICARBONATE
SODIUM NITRITE



Soda Ash • Caustic Soda • Caustic Potash • Chlorine • Potassium Carbonate • Calcium Chloride • Sodium Bicarbonate • Specialty Cleansers • Sodium Nitrite
Nytron • Ammonium Bicarbonate • Para-dichlorobenzene • Ortho-dichlorobenzene • Monochlorobenzene • Methanol • Ammonium Chloride • Formaldehyde

catalysis...

and engineering "know how"

—taking the catalysis out of the laboratory . . . out of the pilot unit into the refinery or chemical plant is a special function of the complete engineering and construction service—*Foster-Wheeler*.

FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

Designers and Constructors of all types of Catalytic Process Units

...with STEEL and STONE and "KNOW HOW"...

Foster Wheeler is building catalytic units in...

ENGLAND
3 big "Fluid" units and a large Poly plant are in various stages of construction.

IRAN
At Abadan, construction on another big "Fluid" unit nears completion.

BROOKLYN
Converting a Houdry into a modern TCC and building a new Poly unit.

Foster Wheeler construction crews are also at work building Catalytic process units in Spain, Canada, and the United States.

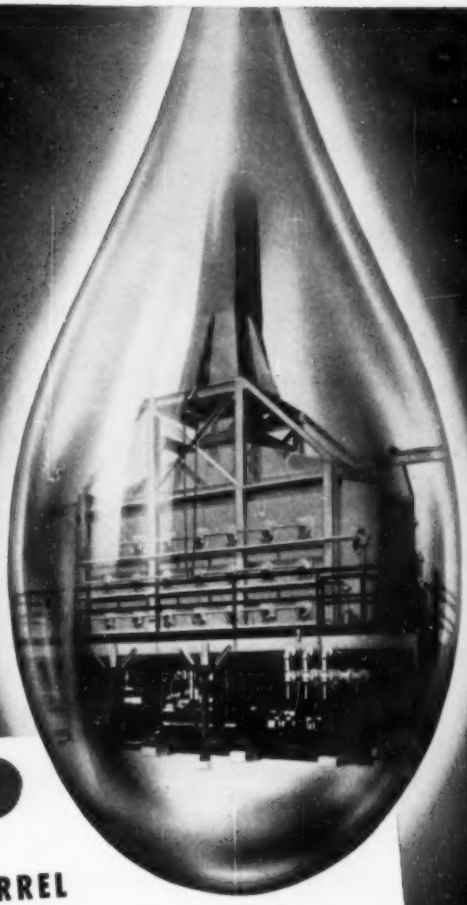
FOSTER WHEELER CORPORATION

165 BROADWAY, NEW YORK 6, NEW YORK

The Complete
Engineering and Construction Service
Anywhere in the World

process units
petroleum refineries · chemical plants

SQUEEZES MORE HIGH OCTANE OUT OF EVERY DROP!



Gradiation

TUBESTILL STEPS UP YIELD FROM EVERY BARREL

Recently in a large Mid-West refinery, the well-known tubestill saw its modern successor installed. The new tubestill utilizes radiant heat to increase the yield from every barrel of crude . . . cuts costs, space required and processing time.

Selas Engineers have designed, built and installed new tubestills that achieve faster heat transfer, more complete combustion in smaller spaces, eliminate hot spots, assure more exact control of temperatures, pressures, and timing. The secret lies in the number and nature of the radiant-cup burners studding each side-wall that permit free time temperature manipulation of the oil's "heat treatment" on the run. It is Gradiation put to work as a precision tool for improved refining.

These new tubestills require fewer tubes and headers . . . less space . . . and a minimum amount of steel work. Refineries can adjust heat transfer rates at any point—to shape the time-temperature heating curve of the fluid to any specification.

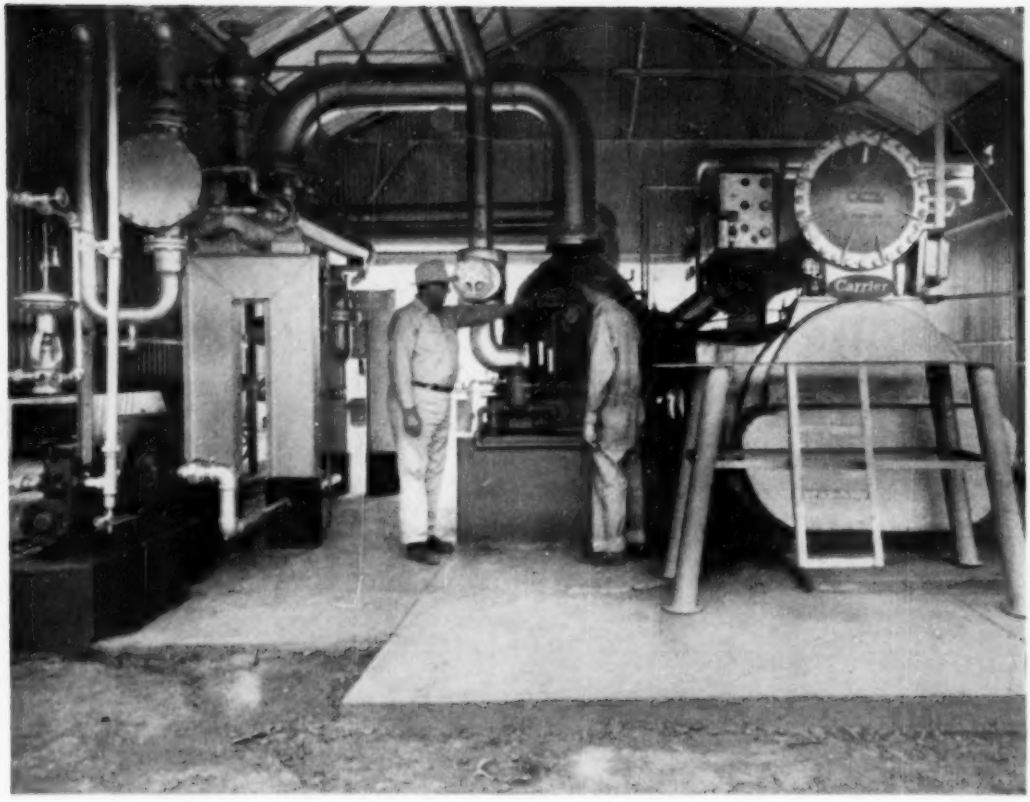
Does this new tubestill, with radiant heat Gradiation, give you ideas for your refinery?

If you're interested in squeezing more out of every drop processed, you'll be interested in discussing *heat processing as a precision tool* with Selas Engineers.

HEAT PROCESSING ENGINEERS FOR INDUSTRY...DESIGN, DEVELOPMENT, MANUFACTURERS

SELAS

SELAS CORPORATION OF AMERICA
PHILADELPHIA 34 PA



Warren Petroleum Corp. increases propane-butane recovery 7000 gallons daily with Carrier Centrifugal machine

---

Superintendent says, "Carrier refrigeration unit increases propane extraction by 10%... butane extraction 7%"

Warren Petroleum Corp. has found that refrigeration of lean oil to increase propane and butane recovery pays. Lower absorber pressures save gas compression. Lean oil circulation is reduced. There are resulting economies in distillation and stripping.

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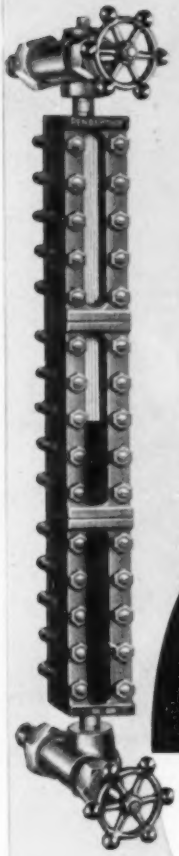

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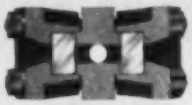
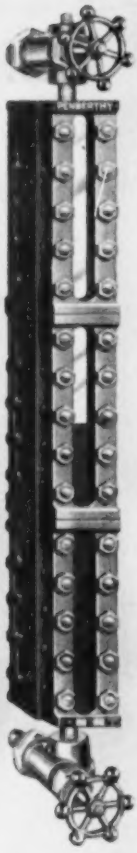


Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction—liquid chamber machined from solid block of metal.



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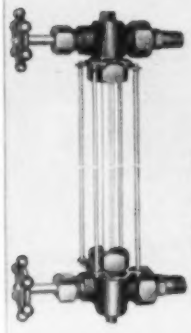

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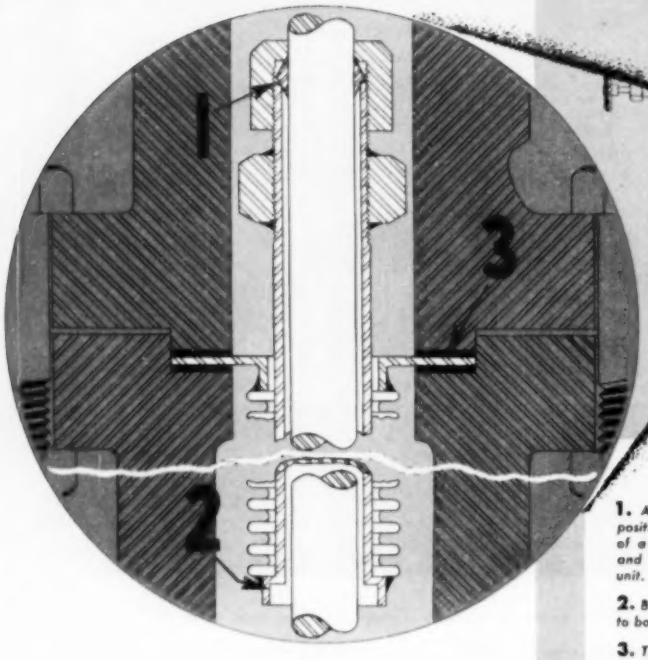

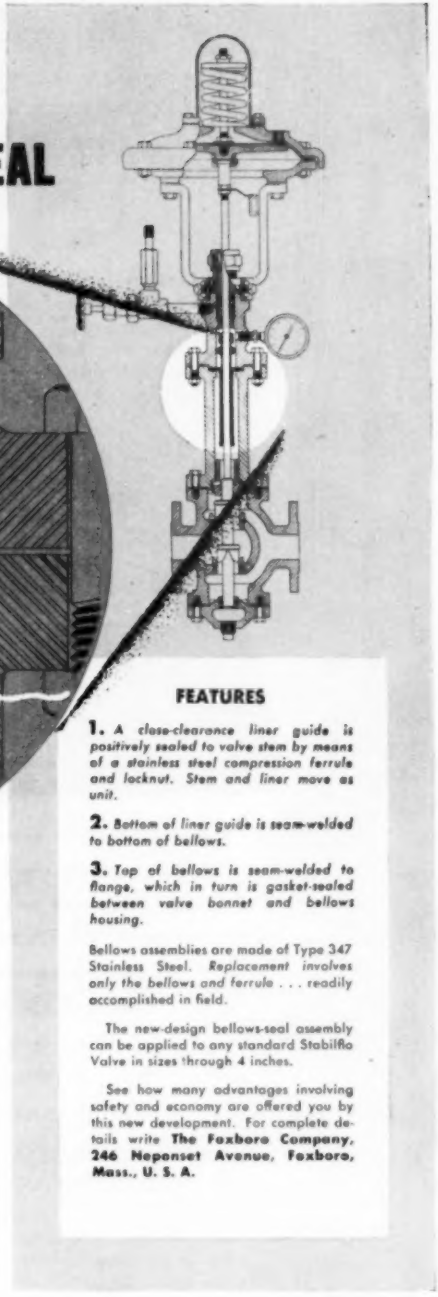

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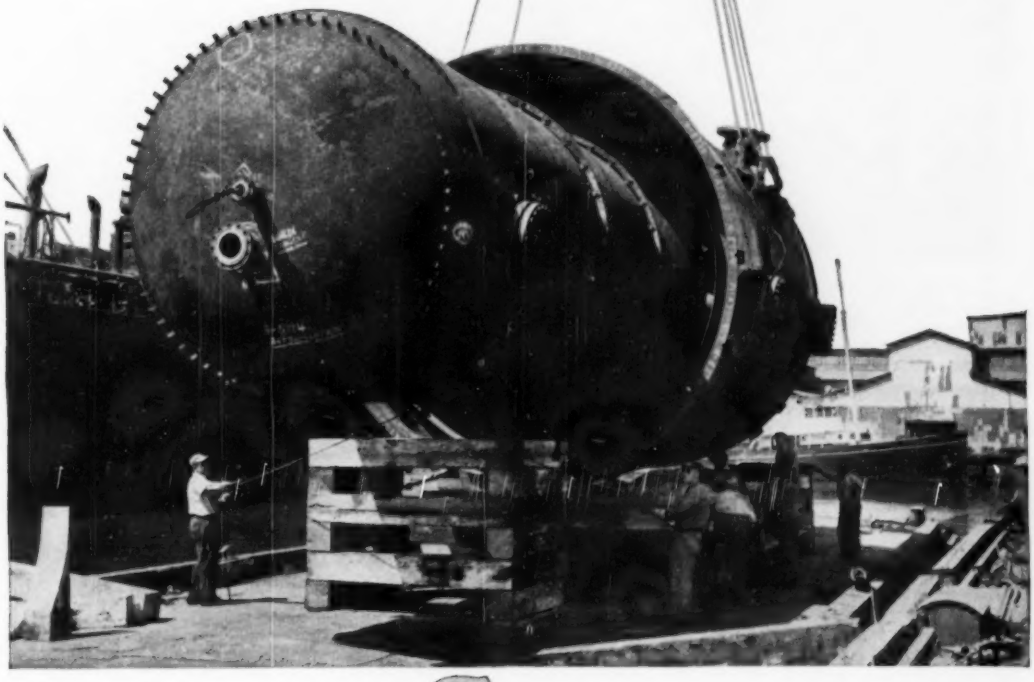

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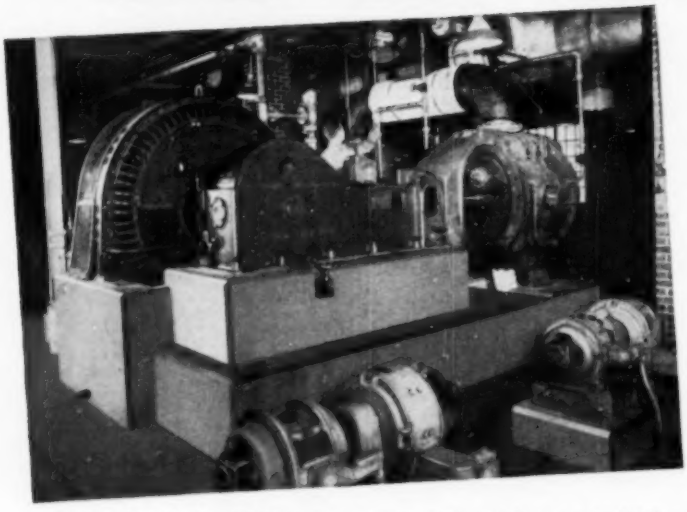

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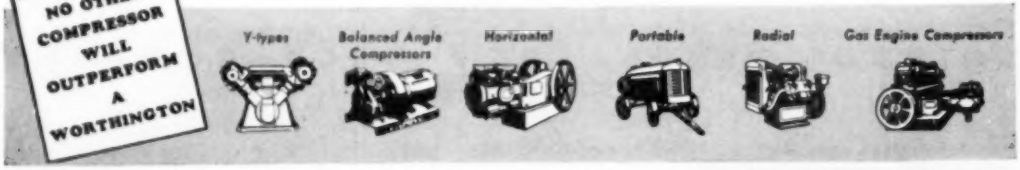

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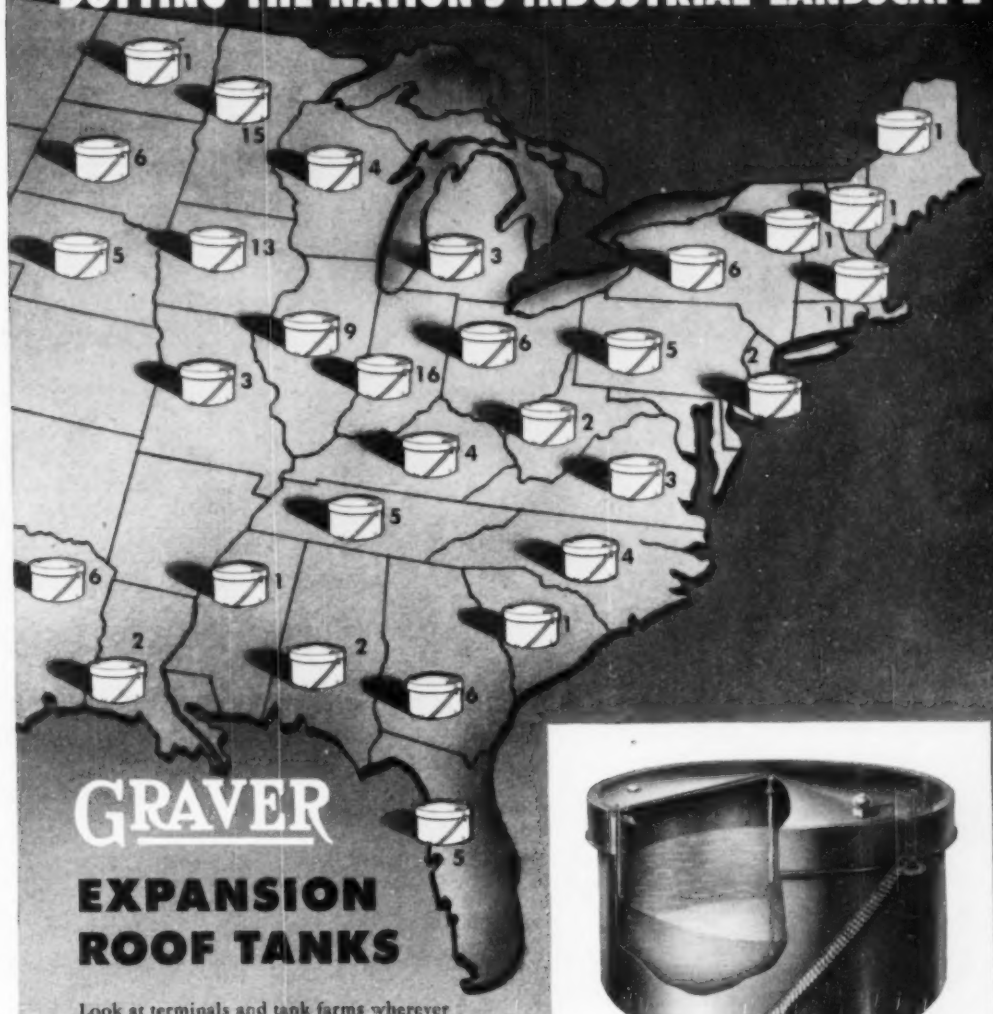

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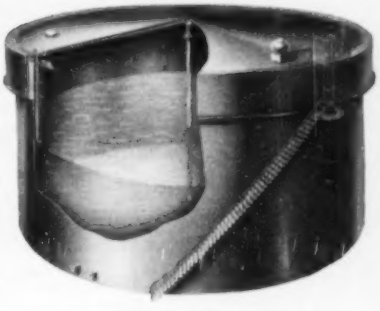

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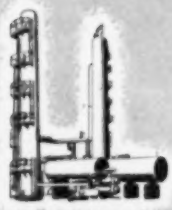

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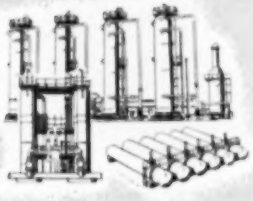

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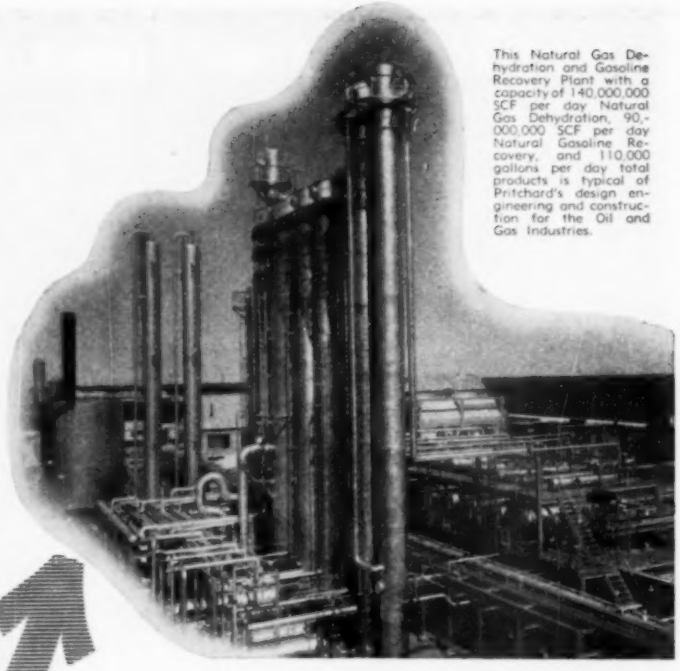

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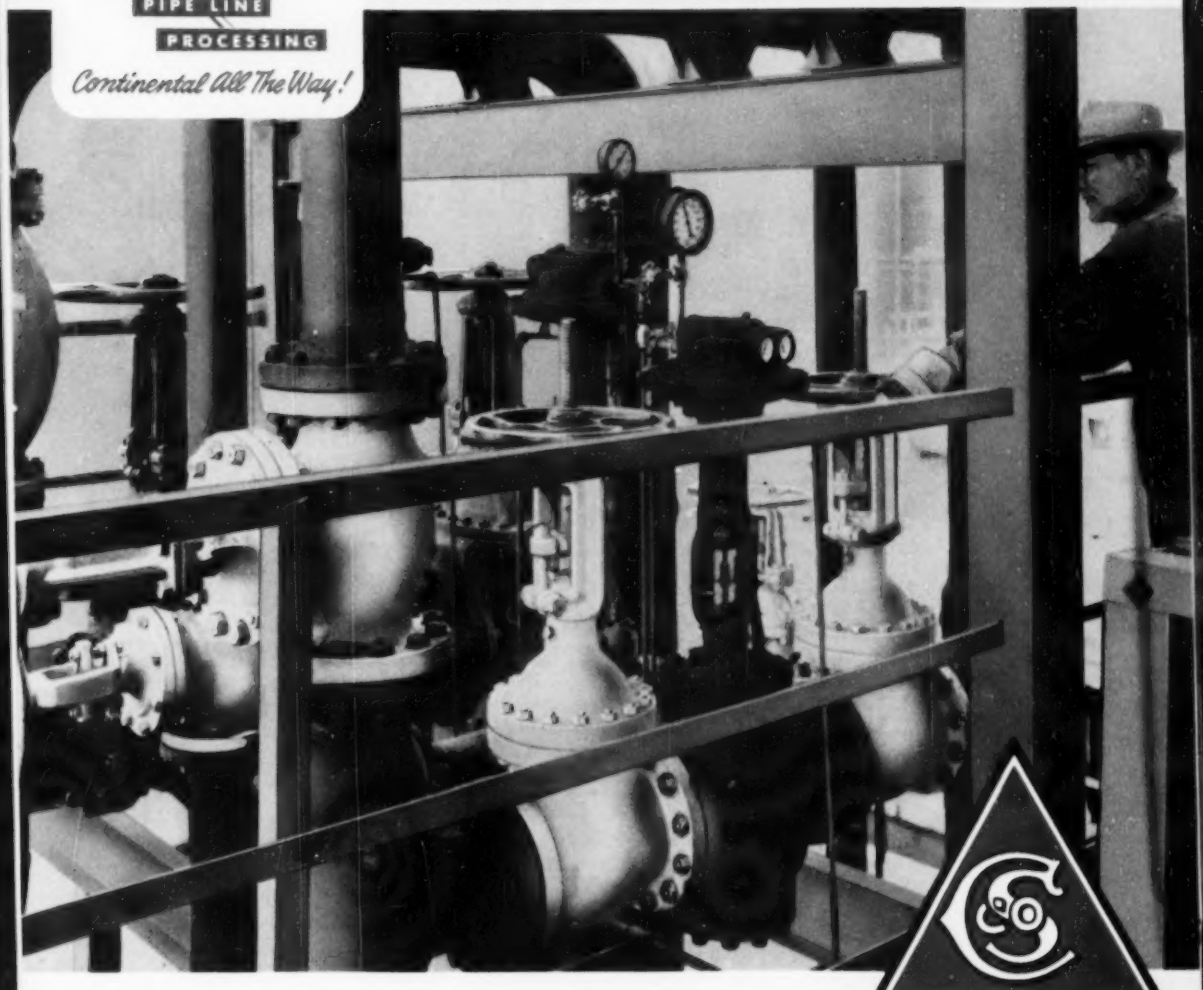

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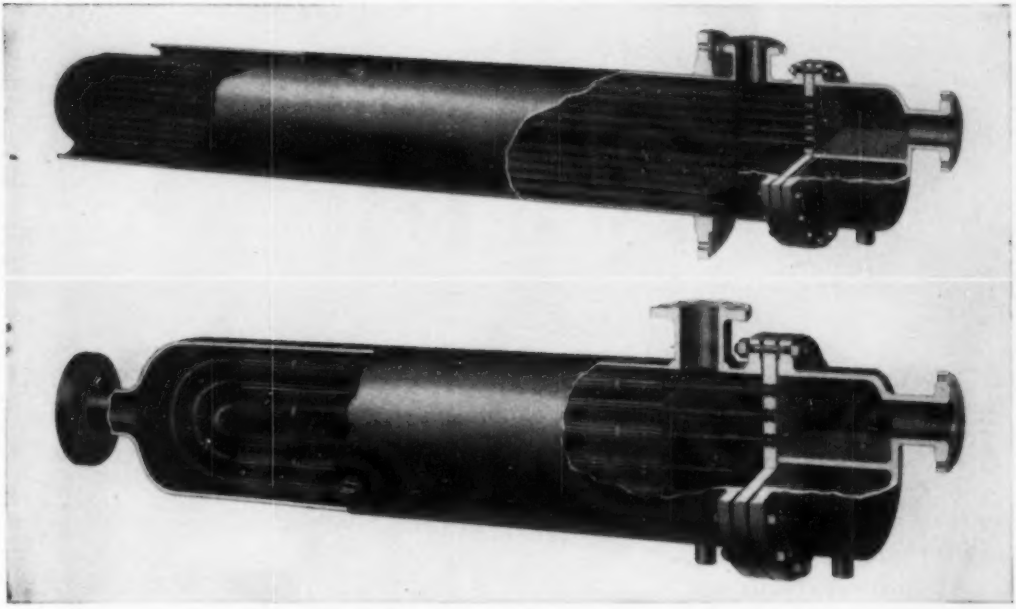

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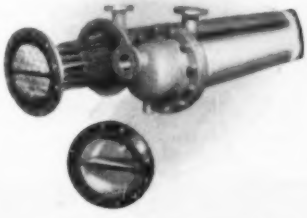

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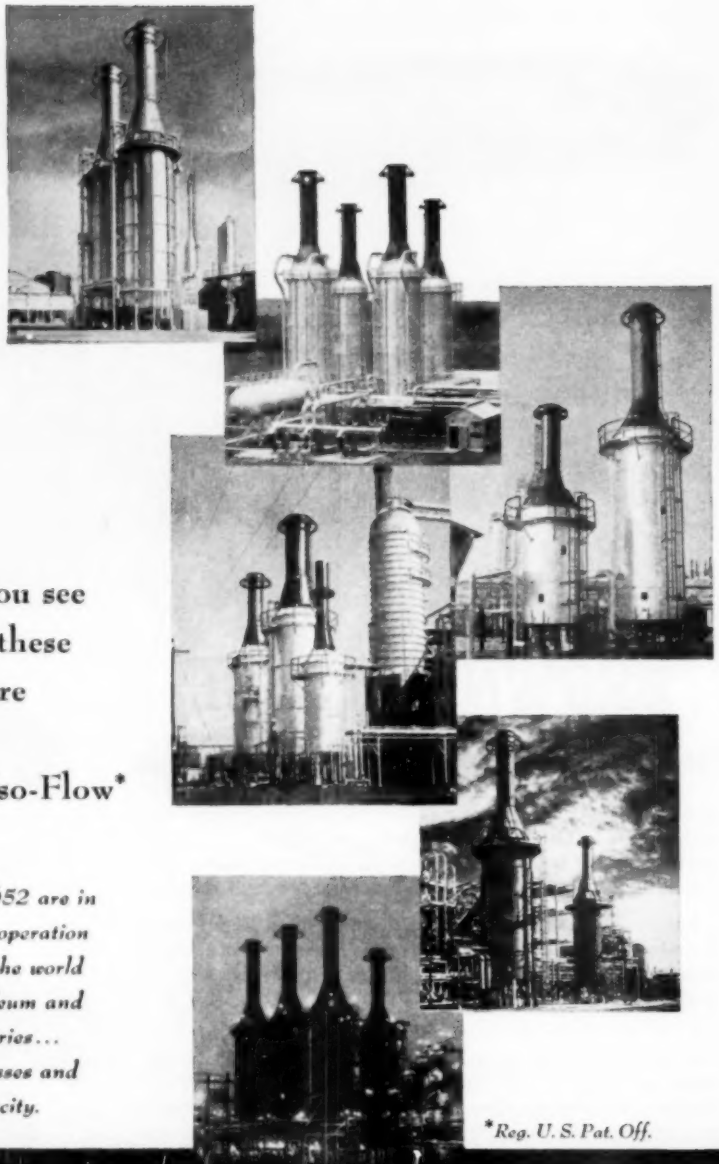

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PETROLEUM PROCESSING
OCTOBER, 1950

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How a Major War Would Affect Refinery Operations, Products

A PANEL forum on the effect of full-scale military fuel requirements on military and civilian gasoline and other petroleum fuels was held by the National Petroleum Assn. during its annual meeting in Atlantic City, Sept. 13-15. Seven representatives of the petroleum industry and military were on the panel. Petroleum Processing made a tape recording of the proceedings, and from that recording and the prepared talks that were available, the story below has been prepared.

One paper in particular dealt with the effect of an all-out military effort on petroleum processing operations—and is presented on the following pages.

Civilian motor gasoline quality will be lowered in the event of an all-out military effort—but not as much as it was during World War II. J. R. Sabina of Du Pont predicted a drop to 80-82 Research octane from the current overall level of about 86. Four of the present octanes, he pointed out, have been added during the past two or three years. Therefore, the drop in level imposed by drastic military demands would amount to approximately two or three years rolling back of the octane count. Major Ray W. Whitson of the Munitions Board Petroleum Committee, on the other hand, estimated civilian gasoline would drop to 76 octane, Research.

Distillate fuel supplies will be cut into deeply by any all-out war's need for jet fuels. C. M. Larson, Sinclair, suggested that some Diesel users would have to learn to use higher end point Diesel fuels, "even though the exhaust smoke level does go up slightly," and that gasoline will have to fill the large demand for light distillate type farm tractor fuel. He criticized the tendency to specify a straight-run component for Diesel fuels on the assumption that stability would thus be ensured. Many millions of barrels of a partly cracked fuel, or a mixture of cracked and straight-run fuel have been used by the Navy and railroads for Diesels, he pointed out.

Residual fuel oil was termed one of the "Hazardous Fuels" by Capt. W. C. Latrobe, U. S. Navy. One hazard, he pointed out, was the lack of stability and compatability. Many manufacturers, he said, have indicated in the last four years that they no longer have a fuel oil for the approved list. Another hazard is the relatively new problem of slag formation at higher operating temperatures in Naval boilers. This problem came to light at the end of World War II. "We still have the problem with us," he said, "and are looking for a specification to eliminate slag in residual fuels; that is elimination of the slag that forms on the super-heater tubes."

Tetraethyl lead will probably be available to the extent that the average TEL content of civilian gasolines can be much higher than in the last war, according to Dr. Edgar Graham of Ethyl Corp. Tetraethyl lead capacity, he pointed out, has been increased from 221 million lbs. per year in 1941 to 350 million lbs. today, with 460 million lbs. anticipated in 1952. Maximum military demand for TEL in World War II, he said, was 155 million lbs. per year.

Antioxidants for motor fuels, to prevent gum formation and decomposition of TEL, may become critically short, according to Dr. Gustav Egloff, UOP. Refiners may be obliged to reduce their requirements for antioxidants to a minimum, he warned, through careful attention to their gasoline treating and inhibiting practices.

T. L. APJOHN, Socony-Vacuum Laboratories, told refiners last month what processing problems they might expect to face in meeting military needs. Seated at left is Dr. Gustav Egloff, UOP.

THE following article has been prepared from a tape recording of the talk Mr. Apjohn presented at the recent National Petroleum Assn. forum in Atlantic City, Sept. 13-15.

Types of Processing Required To Meet Military Needs

From a Talk by T. L. APJOHN
Research and Development Department, Socony-Vacuum Laboratories

THE most pressing processing requirements to produce fuels for military use in time of an emergency are those involved directly and indirectly in the production of high octane number aviation gasolines. These include alkylation, the production and segregation of feed stocks for alkylation — including butylene polymerization, and the production of aromatics and aromatic concentrates. The production of high cetane number Diesel fuels in sufficient quantity may also present a problem if fuel for railroad Diesel equipment is to be included as essential in this quality range.

The question of what military petroleum products will be needed in the time of an emergency and in what quantities is probably one of the most complicated factors in the planning for petroleum mobilization.

It is quite probable that over-all demand for petroleum products for military activities of our ground and sea forces during any next war will not very far exceed those of the last war. Any increase will be only marginal, and we should be able to take care of it with the increased crude running capacity that has been installed during the last three or four years.

It can also be said with a fair degree of accuracy that the quality of products required for ground and sea forces will be about the same. For example, 80 octane all-purpose motor gasoline was used in fairly large volume by the ground forces. We know that that is going to be substantially the same product that it was the last time, although an 86 Research octane number is going to be put into the specification.

Air Force Story Different

In the case of the air force the story will be quite different. Here the quantity requirements will be substantially higher—not necessarily because there are going to be more planes and more men in the air force, but more because there will be larger and heavier equipment, requiring relatively more fuel to carry out the same missions carried out during the last war. Also, there is that trend away from reciprocating engine aircraft to those having power plants of the turbo jet or turbo prop types.

During the last war the maximum demand for 100-octane aviation gasoline was over 500,000 b/d at the peak. This was met, along with the demand for about 200,000 b/d of grade 91/96 and lower.

When we consider this 700,000 barrels, together with the fact that the specific fuel consumption of jet aircraft (that is, the pounds of fuel per horsepower-hour) is about three times that of a reciprocating engine craft, the possible volume demand increase for air activities may be properly oriented.

This defines the fundamental process requirement to produce fuels for military use in time of an emergency —crude running capacity.

No Problem with Jet Fuels

It is a very happy situation that the jet fuel specification presents no special problems as far as processing is concerned. Such fuels can be produced simply by blending proper proportions of a stabilized gasoline and light fuel oil or kerosine type fractions. Some thermally cracked stocks, particularly heavy fractions, are exceptions because of poor stability and tendency to form gum.

However, a few words of caution regarding jet fuel specifications might be said here. The jet engine is still in a relatively early development stage. Possibilities do exist that restrictive changes in specifications may be required as the development of the engine proceeds in order to obtain satisfactory performance. Such restrictions would, however, have to go a long way before they would have us encounter the problems we do encounter in making high-octane number fuels for reciprocating aircraft engines.

The industry is well aware of the fact that right now high octane number fuels are in a critical supply situation. It is not difficult to extrapolate the present situation to an all-out emergency.

Contrary to some impressions and despite the concentration of development on jet aircraft, high octane number fuels will continue to be number one on the priority list of petroleum products. The development of new aircraft and power plants (jet planes and turbo jet props) and the application of these to the numerous types of military activity is a very lengthy process. Consequently, planes powered by reciprocating aircraft engines and their fuels are a long way from being obsolete.

It will be recalled that one of the principal problems faced by the petroleum industry during the last war was furnishing enough grade 100/130 aviation gasoline. This grade fulfilled all combat and a portion of military transport requirements. Commercial and military transport in this country was largely taken care of by 91 and lower octane number fuels.

Avgas Quality Stepped Up

In a new emergency quality requirements will be stepped up in both of these applications. Much of the combat activities and some of the military transport requirements are now based on grade 115/145, and commercial and military transport in this country are based largely on the use of grade 100/130.

We not only have a quantity increase, then, but also a quality increment to take care of.

The key component in making grade 100/130 and grade 115/145 is, of course, alkylate. When it is considered that one barrel of grade 115/145 requires twice as much alkylate as a barrel of grade 100/130, the production problem is pretty clear.

To this higher concentration effect is added the fact that the quality of the alkylate for blending in grade 115/145 must be higher than that used for grade 100/130. Using the hydrofluoric acid catalyzed alkylation process it is not too easy to produce a product meeting the 145 rich performance requirement when the 4.6 cc. of lead are added. And this is true even with the elimination of amylenes and propylenes from the alkylation charge.

World War II throughputs will probably have to be reduced in some cases to meet these quality requirements, and in practically all cases more exacting operating conditions on the alkylation units will have to be practiced.

Alkylation, therefore, constitutes a process of top priority for the production of fuels for military use in time of emergency.

Pertinent to the alkylate supply problem is the availability of feed stocks. As indicated previously, capacity will have to be filled by butylenes rather than with a mixed olefin feed, as was done in many cases in the last war.

Have Sufficient Butylenes

With recent expansions in catalytic cracking there should be sufficient butylenes to more than fill present alkylation capacity. The problem involved is segregating these streams in refineries having this catalytic cracking capacity but no alkylation units, and making them available to those who do have alkylation units.

Isobutane is also threatening to be very short. In the last war we had a number of isomerization units built and operating. Practically all of those have been either dismantled or converted to other uses. Therefore, equipment to gather isobutane will be essential.

During the last war catalytic polymerization units were used to produce codimer, which was hydrogenated to hydrocodimer—an alkylate equivalent. Codimer itself was also used for alkylation feed. There has been some expansion in polymer gasoline production capacity, and undoubtedly this can be used to good advantage to increase the productive capacity for high octane number blending components. The feed used for these polymer units must, however, be restricted to butylene.

There is today competition for butylene between alkylation, essential chemicals, and synthetic rubber. The impact of rehabilitating the rubber program is already having some effect on alkylate production—and the synthetic rubber program is only a little more than half resurrected. Based on experience in the latter part of the war and since the war, the synthetic rubber plants are capable of producing well in excess of design capacity. Consequently, their demands for butylenes are likely to be well in excess of those which we experienced during the last war—and which were so disturbing at times.

Aromatic Blending Components

Second to the alkylate requirement for these higher grades of aviation fuel is the one for aromatic blending components. For those of you who are producing grade 115/145 the need for such aromatic blending components is probably quite apparent.

If the blender does not have sufficient of these components it is necessary to exceed by a substantial margin the 115 lean performance number in order to meet the 145 rich performance number. Generally speaking, one barrel of high-grade aromatic blending agent is capable of increasing grade 115/145 production by three barrels.

It will be recalled that this same situation existed during the last war in the production of grade 100/130. At that time benzene was available for the manufacture of cumene, and we used some 12,000 bbls. a day of cumene to blend into 100 octane number gasoline.

Unfortunately, benzene, together with some of the other aromatics that were used last time, will not be available in the next war. As you are aware, aromatics are currently in short supply. Consequently, there is every indication that the industry should concentrate on those types of processes required to produce either pure aromatics or stocks containing high concentrations of those aromatics. Certain types of catalytic cracking operations will yield the concentrations and, if followed by extraction, can produce relatively pure materials. Catalytic reforming processes also would appear to be excellent sources of aromatics and aromatic concentrates.

High Cetane Diesel Fuels

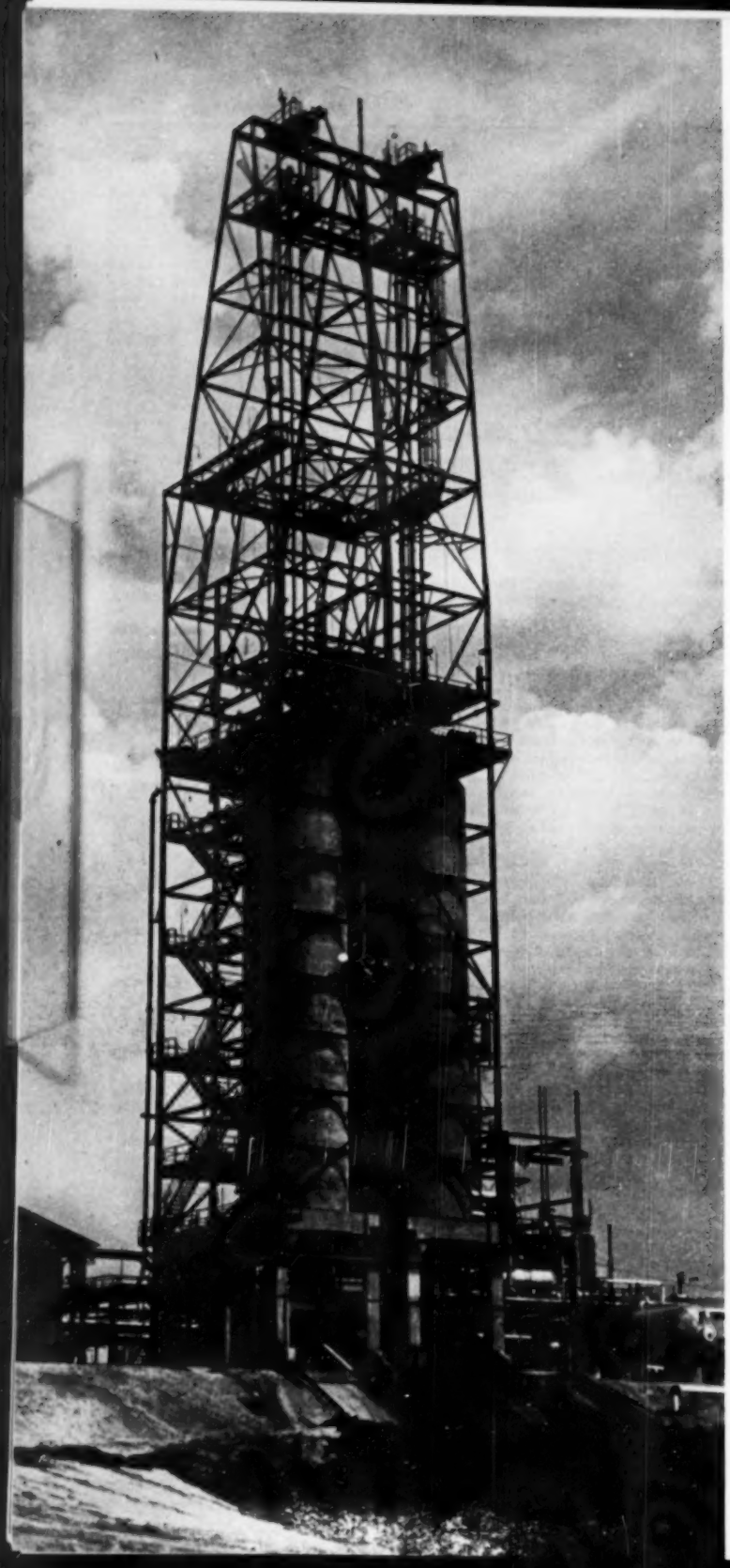
There is only one other product as far as strict military significance is concerned that threatens to approach the importance of the high octane number fuels that have already been mentioned—and that is high cetane number Diesel fuels.

In this case it is the absence of processing rather than processing, along with perhaps some minor amount of crude segregation, that is of significance.

There will be a substantially higher essential demand for high cetane number fuels than existed during the last war. That demand, of course, being for those straight run distillates from predominately paraffinic crudes that so well meet Diesel requirements.

A large part of that demand will be strictly military. However, it seems wise to us to at least plan to meet the rapidly expanding demand for railroad locomotives with this same high quality product. This statement is made with full knowledge that the development of engines used in railroad equipment is being keyed to domestic fuel oils, and that great success has alreay been attained in this direction.

Unfortunately, domestic fuel oils in time of emergency will probably bear very little resemblance to those we are producing today, or those upon which the railroad engine was developed. They can be tolerated in household heating under exigent circumstances, but there would seem to be little point in forcing the railroads to use such poor fuels, thus jeopardizing such a vital activity in time of an emergency.



New 420

By OSCAR A. FUCHS
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Pan-Am Southern Corp.
El Dorado, Ark.

DELAYED coking units have been in operation throughout the country for a number of years. During that time many improvements have been developed, some of which have been incorporated in the new unit which went on stream recently at the El Dorado, Ark., refinery of Pan-Am Southern Corp.

Some of these design features mark this plant as an example of the latest progress in this type of operation. Two large coke drums, 17 ft. 6 in. in diameter and 96 ft. 5 in. from flange to flange, are included in the coke producing facilities. They are believed to be the largest such drums ever placed in operation on any delayed coking unit.

A unique handling system takes advantage of the natural contour of the land at the plant site. Falling coke from the drums passes directly to a de-watering basin below the unit—no coke cars or crushers are used. Decoking water drains from the basin, and a dragline scraper transfers the coke to an adjacent storage pile. A remote control station above the basin and at one side of the drums enables the operator to watch the entire passage of the coke, from drum to storage. Coke handling is illustrated in a simple side elevation view in Fig. 1.

Representative of the latest developments in instrumentation, a graphic panel control board supervises the operation of the process unit.

The El Dorado coker charges 9300 b/sd of 13° API reduced crude, producing 1950 bbl. of depropanized, 400° E.P. gasoline, 5240 bbl. of gas oil for catalytic cracking, and 420 tons of coke daily.

Designed and constructed by The Lummus Co., this plant went on stream August 30, producing its first coke almost exactly one year after the contract was signed. The new facilities were dedicated Sept. 30 in an impressive ceremony.

Considerable economic incentive existed for building a coking unit at El

NEW COKING PLANT of Pan-Am Southern Corp. at its El Dorado, Ark., refinery. Gravity chutes and de-watering basin in foreground

Ton/Day Delayed Coking Unit

Largest Installation of Its Type Incorporates Novel Product Handling System Among Other Design Features; Instrumentation Includes Graphic Panel Control Board

Dorado. Being an inland, southern refinery, it was faced with costly freight penalties on residual fuel shipments to consuming areas. A second Fluid catalytic cracking unit is currently under construction at the refinery. Therefore, in less than a year the coking unit will assume added economic importance in supplying maximum quantities of gas oil for cat cracker charge and ultimate conversion to high octane gasoline.

Process Design and Process Flow

The unit design is based on charging 9300 bbls. per stream day of reduced crude derived from topping a mixture of Arkansas and north Louisiana 34° API crudes. The crude is reduced to about 30% bottoms to make up a coking unit charge of 13° API, 3% sulfur and 15% Conradson carbon. At the design rate, the expected product rates are 1950 b/sd of C_5-400 E.P. gasoline, 5240 b/sd of 25° API, 0.3% Conradson carbon gas oil, and 423 tons/day of coke. These expected yields are shown in Table 1.

The oil flow through the unit is straight forward and similar to the flow in other delayed cokers operating in the nation. A simplified flow diagram is shown in Fig. 2.

Fresh feed is charged to the unit directly from crude topping facilities at about 650° F. From a feed surge drum at the unit, the hot oil enters a combination tower where hot vapors from the coke drums strip light virgin gas oil from the feed; the heavy feed plus a heavy gas oil recycle accumulates in the bottom of the tower. From the tower bottom, oil of about 12.6° API is charged through two parallel coking coils at total design rate of 10,475 b/sd.

The coking furnace is designed for heating the oil rapidly to the coking temperature without coking the tubes, and hence oil flow is through the radiant section only. Design furnace pressure drop is 100 psi. with an inlet pressure of 140 psig. and outlet pressure of 40 psig. Design coil outlet temperature is 920° F.

From the furnace, the outlet streams combine and flow through a master switch valve which directs the flow through similar switch valves to one or the other of the coke drums. The hot oil, calculated to be 65% vapor, enters the bottom of the drum where the liquid reacts to form coke and the vapors flow through the drum at a velocity of about 0.27 ft./sec. Porous coke, believed to average about 50% voids, gradually forms a bed extending from the bottom upward. Oil and vapors must percolate through this bed and consequently near the end of a filling cycle the inlet pressure increases about 10 psi. At design conditions, the drums will fill with 423 tons of coke in 24 hours. The drums are so sized that this coke volume will rise to a height of 63 ft. on the straight sides to leave an outage of approximately 14 ft.

Vapors from the coke drums flow to the combination bubble tower where they are fractionated into gas oil and gasoline plus wet gas. Tower heat balance is maintained by a circulating gas oil stream which generates steam in a gas oil-to-boiler feedwater exchanger.

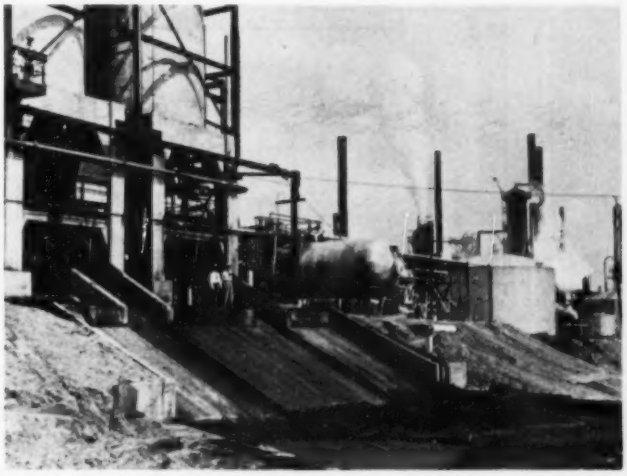
Vapors from the bubble tower flow to a distillate-wet gas separator drum designed to operate at 8 psig. Wet gas is compressed to 65 psig. and recontacted with the distillate. The gas-plus-distillate are cooled and flashed at about 62 psig.

The gas flows through two packed absorber columns in series where 90% of the butanes and 35% of the propanes are recovered. C_3 and lighter dry gas flow to the refinery fuel gas system.

The flashed distillate is pumped to

TABLE 1—Expected Yields from Delayed Coking

Product	b/sd	Vol.-%	Wt.-%
Charge	9,300	100.0	100.0
Gas, C_3 & Lighter			5.1
Gasoline, 100% C_5	1,950	21.5	16.1
Gas Oil, 900° F @ 90%	5,240	56.7	52.2
Coke			26.6
Coke, Tons/day			423



THIS MONTH'S COVER PICTURE shows a closeup of the gravity chutes and de-watering basin for Pan-Am Southern's new coker. Natural land countours have been utilized wherever possible to facilitate handling of the coke

Delayed Coking Unit

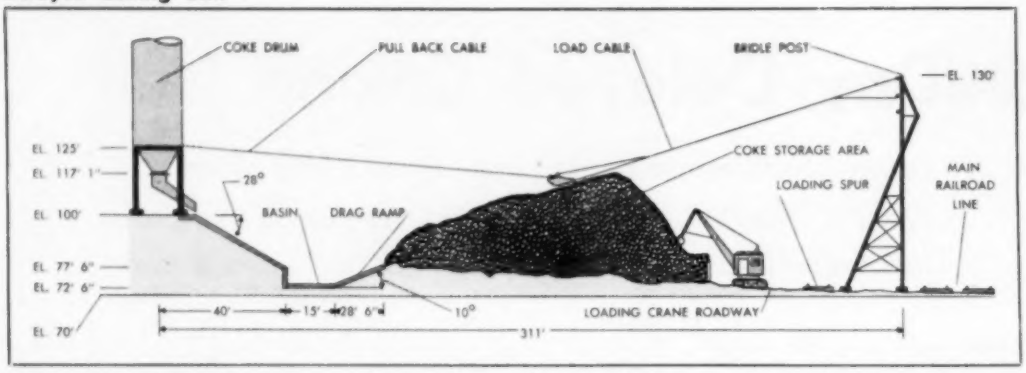


FIG. 1—Simplified side elevation view of delayed coker installation, showing location of unit, coke basin and coke storage with relation to shipping facilities

a debutanizer column operating at 155 psig. where a debutanized bottoms gasoline of about 5 lbs., Reid vapor pressure, and a C_3-C_4 liquid overhead stream is being produced. The debutanized gasoline passes to storage while the C_3-C_4 stream is deethanized and charged to a "poly" plant.

Instrumentation

Relatively mild winter temperatures permit construction of a pump room open to the weather on three sides. The control room building, adjoining the north end of the pump room, constitutes one protective wall. Above the pump room roof, at the south end, structural steel supports carry the bubble tower overhead condensers, two barometric steam jet vacuum condensers and a vertical gas oil-steam generator. Beneath this steel structure on the roof proper are located the gas plus distillate separator drum and the steam generator drum.

An outstanding feature of the unit instrumentation is a graphic panel control board for the coking section proper. The graphic panel instruments are mounted on a portion of the board measuring 6 ft. 6 in. long by 7 ft. 6 in. high. Instruments in the graphic section are indicators and controllers. Circular chart and strip chart recorders are located on each side of the graphic flow picture. An illustration of the control panel is shown in Fig. 3.

An advantage of the graphic panel is the large number of process variables displayed in a small board area. Dial indicators 3 in. in diameter show levels, temperatures, pressures and flows. Pneumatic controllers mounted behind indicating dials of controlled points provide convenient control point reset and automatic to manual switch at the control board.

To speed the response of the furnace temperature controller and the gas oil-chimney vapor temperature controller, special "derivative" units

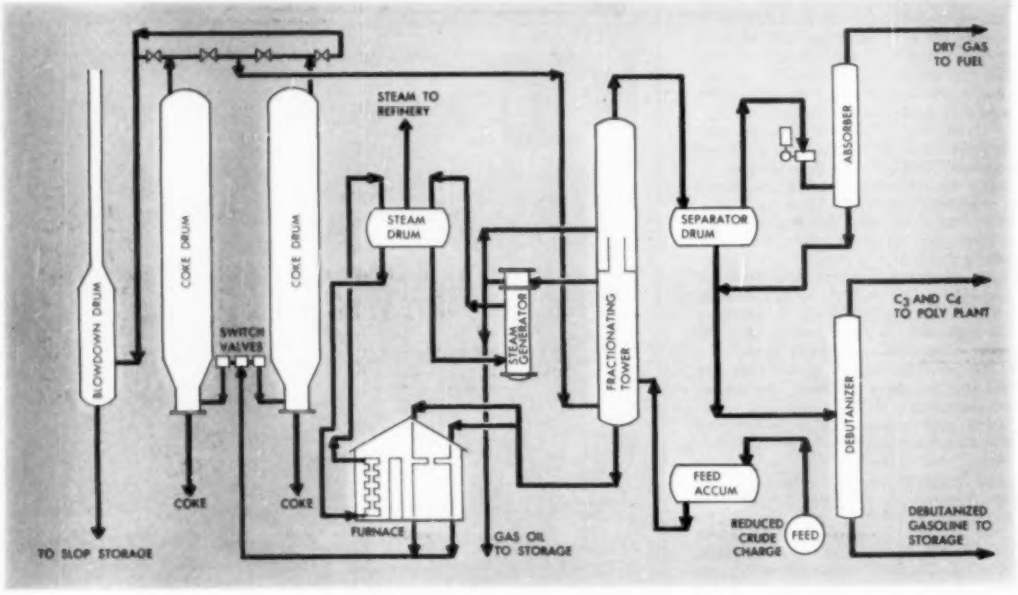


FIG. 2—Flow diagram of coking installation at Pan-Am refinery

were installed in the controlled air circuit. These units amplify any deviation from the controlled point and thus speed up the control valve action to correct the deviation before it has reached appreciable magnitude.

Coke Unit Vessels

Two large vertical drums provide the residence time for the coke forming reaction, and provide the necessary storage space for the 423 tons/day design production. Design vapor velocity is 0.272 ft./sec. Each drum measures 17 ft. 6 in. in diameter by 77 ft. on the straight sides and 96 ft. 5 in. from top to bottom flange.

Drum walls are of carbon steel 1 7/8 in. thick on the shell, 1 in. thick on the elliptical head and 1 3/4 in. thick on the bottom cone. Spot-welded alloy steel lining, Type 405 (11-13% chrome) 1/4 in. thick covers the inside walls.

The vessels were fabricated at the job site from shop-rolled sheets to form one-half of the cylinder perimeter. The half sheets were joined in the field to form ring sections which were welded together at grade level to make approximately half of each vessel. The two half sections were then hoisted into the structure and welded in position.

Located between and below the two coke drums, the condensate drum plays an important role in the daily warm up phase of the operating cycle. This 4 x 10 ft. vessel receives in sequence condensed steam, cold oil, hot oil and finally hot oil plus hot vapors. Vapors from the on-stream drum flowing downward through the empty drum pass out the bottom into the condensate drum whence heavy condensate is pumped back to the bubble tower. Hot vapors from the condensate drum flow to the regular coke drum vapor line going to the bubble tower.

Coke drum vapors are fractionated to produce gas, gasoline, and gas oil plus cycle gas oil, and reduced crude feed is stripped of virgin gas oil in a combination bubble tower.

Tower dimensions are 72 ft. 6 in. on the straight sides and 7 ft. 6 in. inside diameter. The carbon steel walls measure 1/4 in. thick. Strip welded alloy lining 1/8 in. thick, Type 410 stainless steel, covers the interior from the bottom up to the first bubble deck. These alloy strips are 4 in. wide.

All tower internals are alloy steel. Beginning immediately above the bottom accumulator section, five baffle decks with saw tooth weirs provide contact between heavy fresh feed and coke drum vapors. A gas oil drawoff pan and vapor chimney lie above the baffle decks. Four shower decks, located above the chimney, effect a knock back of heavy gas oil in the hot vapors rising from the chimney by contact with circulating gas oil reflux.

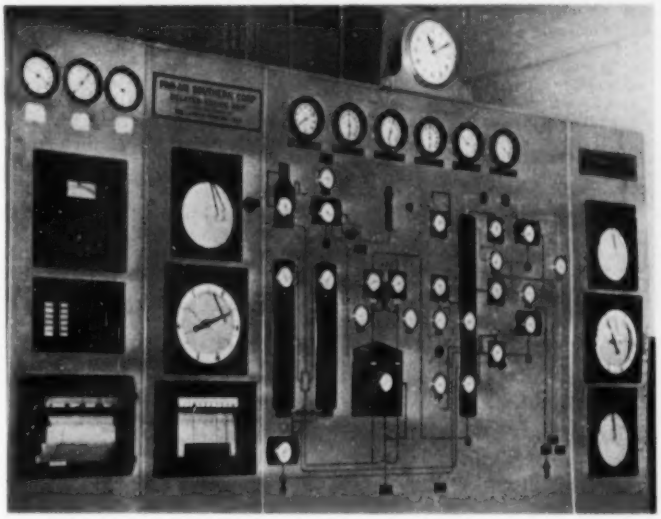


FIG. 3--Graphic panel control board for the Pan-Am coking unit

To prevent coke particles from entering the furnace charge pumps, a vertical cylindrical screen approximately 8 ft. tall was installed on the bottom draw-off nozzle.

Lummus and Pan-Am inspectors cooperated in checking the vessel fabrication. Shop welds were spot X-rayed and stress relieved; field welds were subjected to magnaflux particle inspection. The vessels were stress relieved in the field. A large burner, installed in the bottom head and connected to natural gas and an air blower, supplied the required stress relieving heat. One drum was soaked for five hours at 1000° F. and the other for seven hours at 950° F.

Furnace

The furnace was designed specifically for coking operations. The radiant section, containing only oil tubes, provides a maximum heat pick up in a minimum of time. The oil enters the furnace in two parallel streams flowing through identical coils containing 46 tubes arranged in two rows of roof tubes and one row of wall tubes. Direction of flow is from the outside of the upper roof toward the center of the radiant fire-box, down to the lower roof, outward to the wall and down the wall tubes to exit near the bottom.

In a furnace designed for heating oil to coking temperatures without producing coke in the furnace tubes, velocity-temperature relationships become critically important. Based on design throughput of 10,475 b/d of 12.6° API charge, the cold oil enters the tubes at approximately 5 ft./sec. At 800° F., design calculations indicate that the charge is less than 1% vaporized and that the velocity is about 6.5 ft./sec. A calculated velocity of 10 ft./sec. is reached at about 840° F. To prevent coking in the critical 5-10 ft./sec. velocity and the 800° F temperature range, 275 psig. process steam has been provided for injection at the inlet to the lower roof and at the inlet to the wall tubes.

Design operating conditions are 700° F. inlet, 920° F. outlet temperatures; 140 psig. inlet and 40 psig. outlet pressures. Fuel gas flow to the furnace is controlled by the oil temperature in a tube located in the wall bank ten tubes from the outlet. The furnace convection section employs water tubes to cool the convection gases and to generate 150 psig. steam.

Gas fired floor burners, 48 in number, provide a total heat release of 54,300 MBtu./hr. The total heater duty is 42,800 MBtu./hr. with 34,000 MBtu./hr. required for oil heating and 8,800 MBtu./hr. absorbed by steam production.

Alloy steel was used throughout the coking coils of the furnace. Coking coil tubes contain 6-8% Cr. and 0.45 to 0.65% Moly. These tubes are 4 in. I.D. with 1/4 in. wall thickness and are 36 ft. long. The oil headers have bodies and plugs of cast alloy steel containing 4-6% Cr, 0.5% Moly.

Blowdown System

The essential equipment items in the blowdown system include a vertical blowdown drum 8 ft. I.D. and approximately 20 ft. tall, a blowdown

stack on top of the drum 3 ft. I.D. and extending to a height of 135 ft. and three slop tanks totaling 3,300 bbls. capacity.

In regular operation the function of the blowdown drum and stack is to condense oil vapors purged from the hot coke drum which has been taken off stream. Inside the drum, five shower decks distribute a water stream entering from above to form a condensing curtain through which the vapors must pass. These shower decks are made of 10-gauge, 18-8 chrome steel. The drum itself is carbon steel with adequate corrosion allowance.

To keep heavy, waxy materials in a fluid state, a 2 in. spiral steam heating coil was installed on the outside surface of the bottom dished head. To avoid excessive stack temperatures a temperature controller will open a valve to inject additional cooling water as required.

Condensed oil and water flow by gravity to the slop tanks whence the water will be drained to the sewer and the oil returned to the coking unit.

Hydraulic Decoking Equipment

Jet Pump—The jet pump plays a most prominent role in the decoking operations. An eight-stage centrifugal pump delivers 700 gpm. at 1900 psig. to the decoking water header at ground level. Pressure at the top of the coke drums averages approximately 1825-1850 psig.

A multistage steam turbine operating on 275 psig. saturated steam and exhausting at 25.5 in. Hg. vacuum supplies 1110 hp. at 3550 rpm. to drive the jet pump.

The high pressure water stream requires special control to protect the piping from impact shock and to allow shutoff during decoking operations. Three air operated valves function simultaneously to control the turbine speed, and to direct the water stream either to the decoking water piping or to a by-pass return line.

The water flow control valves are air-loaded as well as air-operated. The control valve in the main discharge line is 6 in. while the by-pass valve is 2-in. An air control station located at the top of the coke drums is so designed that, at minimum air loading, the 6 in. valve is closed and the 2 in. by-pass opened while at the same time a spring-loaded air-operated valve in the steam line to the turbine is throttled to reduce turbine speed to one-third normal. At maximum air loading the valve actions are reversed and full water flow at maximum pressure is charged to the drill stem.

Decoking Water Piping—Water from the jet pump flows up to the top of the coke drums through a 6 in. line. At this level, the line branches to two systems, one over each coke drum. When one branch is in service the other is blocked off by means of swing joints and "unibolt" coupling bull plugs.

Additional flexible connections are needed in the piping extending upward to permit vertical travel of the drill stem as the cutting proceeds inside the drum.

A permanently mounted drill stem over each drum delivers the high pressure water to cutting jets. Three pieces of 6 in., Schedule 160, seamless pipe were joined by welding to make a straight stem 100 ft. long for each drum.

Drilling and cutting heads are alternately attached to the bottom of the drill stem by unibolt couplings. The drilling head contains four nozzles pointed downward; the cutting head has only two nozzles directing water jets horizontally through the coke bed.

Drill Stem Hoisting Equipment—Heavy hoisting equipment, designed for 16,000 lbs. dead weight load, raises and lowers the drill stem and top cross-head during decoking operations. The cross-head, which is guided in a vertical rail channel, supports the connecting swing pipes, the drill stem, and a rotary air motor. A single strand of $\frac{7}{8}$ in. wire rope runs from the hoist drum to the top, over a 26 in. traveling block and returns to a firm fastening at the bottom of the top beam. The sheaves and traveling block turn on 3 in. diameter axles.

The cable drum and power equipment are mounted at the same level as the coke drum top heads. A 15 hp. piston-type, air motor drives the heavy cable drum through a herringbone gear reducer with an input speed of 550 rpm. and reduction ratio of 87 to 1. The cable drum consequently revolves at about 6.3 rpm. At an average drum diameter of 2 ft., the cable travels approximately 40 ft./min. and the traveling block one half this speed or 20 ft./min.

A rugged steel derrick constructed above both coke drums supports the drilling cross head, drill stem, guide channels and decoking water piping. This structure rises upward to 234 ft. above grade. The cable hoist load sheaves are mounted on the top platform.

Coke Handling Equipment—The El Dorado coke handling system probably differs from that used on other coking units in the nation. One method for handling the product pouring from the bottom of hydraulically decoked drums is to permit both coke and water to drop into cars beneath the drums. The water drains through holes in the cars, and the coke is transported to a storage area.

Anoter method employs a crusher which reduces the lumps to a size which may be pumped in a water stream to coke storage. Neither of these methods is used at El Dorado.

The elevation of the El Dorado coking unit with respect to an adjacent storage area permits the coke to flow by gravity from the drums to a dewatering basin, whence it is dragged to storage before loading into shipping cars. A side elevation view showing the coke handling system appears in Fig. 1.

The contour of the land permitted a simple, yet unusual design for coke handling. The area immediately adjacent to the coke drums is approximately 35 ft. below the unit grade level. Steel chutes, inclined at an angle of 28° and extending from a platform about 4 ft. below the bottom of the coke drums, rest on concrete chutes, also inclined at 28°, to channel the coke into a dewatering basin. In this basin, water drains from the coke and flows through screens on each side to a decoking water separator box. The walls of the steel chute are 3 ft. high while the concrete chutes are recessed 8 in. in a concrete apron.

To remove the coke from the dewatering basin at approximately at the same rate as it flows from the drums, a dragline system is used. The principal items of equipment for this system are 1—two tail towers each 60 ft. high, 2—three cable drums driven by an electric motor power unit, 3—a monorail at the coke drums and 4—a four-cu. yd. crescent-shaped bucket. The two tall tail towers, which stand 200 ft. apart, support a fairlead sheave for the $\frac{7}{8}$ in. pullback cable and support a $1\frac{1}{2}$ in. bridle cable from which a $\frac{7}{8}$ in. drag cable is suspended. These cables attach to the dragline crescent bucket and pass around the sheaves on the monorail at the coke drums.

The dragline system features a remote control station located above the dewatering basin at one side of the coke drum structure. From this position the operator has full view of the coke falling from the drums into the basin and of the coke storage area. The electric controls are connected to the motor and cable drums located near the tail towers 350 ft. from the operator's platform.

In operation, the dragline is capable of moving about 145 tons/hr. out of the basin, over an inclined ramp to temporary storage close to the basin. This intermediate storage will permit additional water drainage. After a drum is clean, the coke is dragged from the temporary storage pile to a shipping point near the loading track. Following a minimum of 24 hrs. draining time, this coke is loaded by a clamshell crane into shipping cars.

The area available between the dewatering basin and railroad tracks provides storage for about 12,000 tons of coke or about 30 days running at design capacity.

Set Up Refinery Protection Plans Ahead of the Hour of Danger!

A Review of "Principles of Plant Protection" Revised Pamphlet Issued by U. S. Defense Department

THE importance of organizing, or improving, security measures within the individual refinery or other industrial plant, in advance of the time the enemy may strike, is emphasized in the report "Principles of Plant Protection", recently issued by the Defense Department, Washington.

The difficulty of making a sudden open attack on our mainland, even with long-range aircraft and modern missiles, suggests that war against the U. S. might open with, or be accompanied by, attempts at mass sabotage in key industries, it is brought out. Petroleum refineries would undoubtedly be included in this category.

The military authorities state that, therefore it is imperative that all practicable measures be taken to reduce the hazard to continued production, through the maintenance of security, by anti-sabotage measures, and including the planning and preparation to handle the results of enemy open attack.

Management's Responsibility

The responsibility for internal plant protection must rest basically with management and the operating personnel, the report brings out. No outside authority such as the Armed Services or other government agency is in a position to determine the danger spots in any individual plant and the effective means of preparing for and reducing such hazards. "Management should give immediate consideration to the problems involved and should initiate studies of plant protection, with a view to putting into effect such measures as may be within its capabilities", it is stated.

As an immediate start, the report suggests that some executive be assigned the task of figuring out for the particular plant the best means of sabotage that might be employed to slow down production or bring about a major shutdown. Such a study would furnish a key to the internal security program that should be set up there.

Since the delineation between peace and war is much less sharply defined now than in times past, the report states it would be realistic for plant management to assume that efforts are already being made by enemy agents to collect information on vital war plants. The information they seek includes: Production rates and details of orders on hand; test data on new products already being manufactured or in the development stage; data on production methods; critical points for sabotage; security measures including the dependability of guards; knowledge of dissatisfied labor elements that might be used in subversive plans of various kinds.

Many methods are used by enemy agents to collect and piece together plant information. Management is warned against the use of "fronts" such as fake commercial concerns, import-export associations, pseudo-scientific organizations, and so on to collect important plant data under false pretenses.

A high degree of ingenuity must be expected in plant sabotage, the report brings out. Labor sabotage is often the most difficult to detect, it is stated, because a definite distinction sometimes is not possible between minor sabotage activites and legitimate labor disputes, which can bring about strikes, "slowdown" operations and other work disruptions.

"Internal plant security comprises security of information, the prevention of sabotage and combating subversive efforts," states the Defense Department's booklet on 'Principles of Plant Protection'. There are also normal peacetime measures for prevention of lost time and damage which, if actively prosecuted, will increase production and may reduce the effectiveness of enemy efforts. Fire protection, safety training, installation of protective devices and maintenance of sanitary conditions come in this category."

Watch Classified Information

Managers of refineries and oil company research and development departments are responsible for the security of classified information which comes into their possession through contracts with the Army, Navy and Air Force. In the case of such work, administrative arrangements and methods should be adopted which will make espionage difficult. Among such provisions discusses in the report are: Separation of employes working on such projects from employes under less strict surveillance and the location of such work in areas where absolute security can be maintained; issuing of safe combinations and keys to a minimum of personnel; complete control of correspondence to make sure that extra copies of letters and reports cannot be made and delivered to outside agents; destroying carbons and scrap paper that might provide valuable data; close check and surveillance on janitors and charwomen.

A close checkup is advised of the company identification system both for plant workers and visitors, and of the extent to which workers can move from one department to another, in the interests of internal plant security.

Among the general measures for physical protection against sabotage, the report suggests that special protection such as fences, walls, lights and alarms be given to key machines and equipment, particularly those hard to replace and where damage would seriously affect the plant's protection.

Plant management should intensify their fire and accident prevention programs in the interests of internal security, the report states. Starting fires is known to be an important means of sabotage. Saboteurs also may inactivate devices to prevent or control fires simultaneously with the setting of fires.

Prepare for Outright Attack, Too

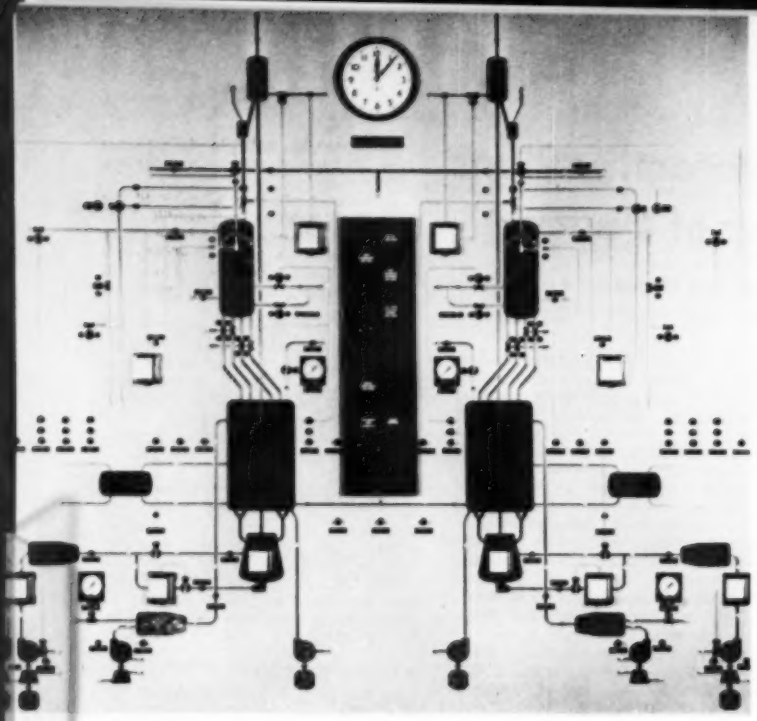
In the case of outright enemy attack, the plant protection program should concern itself chiefly with means for disaster relief and control of physical damage, for these problems will be much the same regardless of the type of missile used.

From a practical viewpoint, an essential requirement is that the active means of control, rescue, first aid and fire fighting be assured by protective construction to the fullest extent practicable, in order that relief work and the control of damage done by attack can be carried on.

Detailed methods for the control or shutting down of process units in the event of an enemy attack should be worked out in advance of their actual need by the plant engineering staff. Consideration should be given to provision of an emergency supply of water in reserve tanks, which, however, could supply only limited needs. In general, in fire fighting primary dependence should be given to methods that do not require water, since it can be assumed water systems would be put out of use in case of attack on the plant or community.

An emergency repair unit should be organized, the personnel consisting of men experienced in maintenance of services and operating units. Safe shelters should be installed to contain duplicates of vital plans, drawings and so on required to reestablish production if the plant is damaged.

The new pamphlet "Principles of Plant Protection" supersedes Pamphlet 32-1, "Plant Protection for Manufacturers", issued in 1943 by the Army and Navy. Copies can be secured through the Industrial Security Division, Office of Manpower, Munitions Board, Department of Defense, Washington.



TYPICAL OF THE TREND in process control is this latest graphic panel designed for a new Thermofor catalytic cracking unit at the Cleveland refinery of Standard Oil Co. (Ohio)

Automatic Refineries In a Few Years

Annual Instrument Show Keynotes Approach of "Push-Button" Plants

By WILLIAM C. UHL
Equipment Editor

A COMPLETELY automatic petroleum processing plant becomes less a dream and more a reality each year as new ideas and new equipment are disclosed at the annual Conference and Exhibit of the Instrument Society of America. The Fifth national meeting in Buffalo a few weeks ago was no exception. As the chief instrument engineer of a leading oil company said during one of the technical sessions, "I predict our company will have a completely automatic refinery in five years."

This statement was made in a lively discussion period during a well-attended open forum on graphic control panels. It was echoed in modified form by many other oil industry instrument engineers at formal meetings and in informal gatherings in the halls, on the exhibition floor, or wherever two or more persons got together for a chat.

Although there are still many obstacles confronting the ultimate goal of a "push-button" plant, they are gradually becoming less insurmountable. The automatic refinery will come, whether it takes five years, or ten, or more. It is merely a matter of time and dependence on the ingenuity of instrument engineers, designers, makers, and users.

Exemplary of the progress being made against one troublesome problem was the full-day symposium on flow control the day after the graphic panel session. A series of five papers was presented by as many different instrument manufacturers, each giving his solution to the problem, particularly as it is affected by transmission lag—the speed of response of a control is cut down by the distance from the central control room. After lunch, the entire afternoon program was devoted to an open discussion on this question, participated in by the five speakers and the members of the audience.

Further examples of the way in which petroleum processing is progressing rapidly toward automatic control were several other papers during the 13 technical sessions at the ISA Conference. Among these was one describing a monitoring system installed at Sun Oil Co.'s Toledo refinery which employs a technique similar to a telephone dial scheme for obtaining a temperature record from as many as 1000 different locations in the plant on one record.

Another paper described the use of radium in an atomic energy-operated level indicator for measuring catalyst level in cracking plants. This instrument, it was brought out in the discussion period, is also a potential tool for rapid determination of the atomic number of a fluid passing through a process line.

The use of a mass spectrometer for monitoring continuous processes by automatically analyzing process streams was described in still another technical paper. Spectrographic instruments of both the mass and the infra-red type are under serious study and investigation as process control tools by many oil companies today.

Competing with the technical papers for the interest of the over 6000 conference registrants were many new instruments and associated devices on display in the exposition hall. Some of the new products which proved of high interest to petroleum instrument engineers included:

1—Automatic gas analyzers of several types which it is believed will lead eventually to more precise, rapid, and efficient control of process units in refineries and petrochemical plants. These analyzers included several for oxygen measurement and others for hydrocarbon analyses. In another instance, two manufacturers had combined conventional instruments to

form a new device for improved process control.

2—An electronically-operated remote reading tank gaging system which includes a simultaneous indication of the temperature in each storage tank.

3—The atomic energy-operated level indicator which was designed for the particularly difficult problem of catalyst level control in catalytic cracking units.

4—Several engraving machines by which a refinery instrument shop can economically make its own instrument panel signs, symbols, etc.

The exposition, which ran the full week of Sept. 18-22 along with the Conference in Buffalo's Memorial Auditorium, included displays by almost 150 different manufactuers.

Graphic Panel Forum

The graphic panel idea in instrument control is here to stay. However, it has imposed a few problems which must be and are being solved before it will reach a stage of completely satisfactory operation. These facts were emphasized in the open forum on the subject at the ISA meeting. Louis Gess, Brown Instrument Co. and one of the panel speakers, traced the historical development of pictorial type instrument panels and explained how some of the earlier problems were solved. The Brown company was one of the pioneers in the development of the graphic panel. Mr. Gess gave a paper on the subject at the ISA meeting in Philadelphia in 1948, and his company supplied some of the earlier panels to be built in oil refineries. A spokesman for Shell Oil Co. told PETROLEUM PROCESSING his firm installed a Brown panel at Wood River four years ago. That panel, far simpler then those of today, followed design engineered by Shell personnel. It was a result of necessity when the refinery found itself faced with the problem of fitting instruments which would normally require about 12 ft. of space into a section a little over three ft. wide.[1, 4]

A. F. Sperry, president of Panellit, Inc., discussed costs and design pitfalls in the graphic panel.[2, 3, 4] He showed the many variations possible in complexity of this type of panel and explained how the cost is affected by the density of instruments per square foot of panel space. The cost per foot for a graphic panel may range from 25-30% more than a conventional panel, Mr. Sperry said, to as much as 200-300% more, depending on the complexity of the installation. Most panels for petroleum processing plants, he went on, fall in the lower end of this range, while panels for power plants or some chemical process units hit the high ranges.

However, he pointed out that when the two types of panels are compared on the basis of total cost, they are

ATOMIC ENERGY IN INSTRUMENTATION has caused refineries to build special pits for storing radioactive materials like this one at the Toeldo refinery of Sun Oil Co.

nearly equal, with a plus or minus variation of about 15%. Cost of the panel itself, therefore, is not the controlling factor in a choice between the two designs, Mr. Sperry added. Other factors which must be considered are savings in total control room space, improved operator training, lowered maintenance, and the like. It must be emphasized, he said, that the graphic panel is not an all-inclusive answer to all process control problems. In some cases, conventionally-designed panels may be the best solution. In others, a properly designed graphic can assure the plant operator of substantial savings and operating improvements.

User's Experience

Reporting on the experience of a user of graphic panels, Walter S. Bowers, Standard Oil Co. (Ohio)[7] said one of the big problems still facing graphics today is their inability to follow process trends accurately and rapidly in the event of an upset. Sohio, however, is very well pleased with the operation of graphic panels on a new lube oil unit[8] and a vacuum still at the Lima, Ohio, refinery. Start-up operations on these units, which went on stream early this summer, were greatly facilitated, Mr. Bowers said in his ISA paper. "Explanations were clearer, difficult situations easier to handle, and operating techniques developed more quickly," he said. "The newer men found themselves able to associate instrument functions, operating practices, and equipment more clearly. Veterans, too, found the pictorial diagrams of great value in sizing up situations."

One shortcoming of the installation at Lima, Mr. Bowers said, is in the multi-point recorder. This instrument makes a chart record of vairables from as many as six different primary sources by successively printing each signal in the form of a dot.

"We find the normal 36-second printing cycle too slow to give an easily readable record in times of 'upsets.' This is especially true with rapidly changing variables such as flows and pressures," he stated. "A faster printing cycle, or preferably a graphic recording station should provide the solution." Other instrument components of a graphic panel system have performed very satisfactorily at Lima.

The system does lack flexibility when changes are necessary due to alterations in the process, Sohio has found. Some minor rearrangements can be handled, however. For example, a liquid level controller was needed on one of the towers. This single indicator was added without any trouble. Major changes have not as yet been required, but will obviously necessitate a careful study of the diagram before they can be accomplished.

The company's instrument men have been almost unanimous in agreeing that the graphic system helps them to understand and become familiar with the unit faster. In one instance, an operator reported trouble in maintaining stable control of a furnace outlet temperature. The instrument man assigned to find the difficulty analyzed the situation quickly from the pictorial diagrams. The entire problem was solved in less than 30 minutes.

The smaller size of both the in-

The ISA Recommended Practices Committee

ONE of the most important functions of the Instrument Society of America is its extensive work in the preparation of recommended practices for plant and laboratory instrumentation. Many petroleum engineers are serving the Society in this work, both as chairmen and as members of the various subcommittees. W. H. Fortney, chief instrument engineer, Humble Oil & Refining Co., Baytown, Texas, is chairman of the general committee.

A report on work of the ISA Recommended Practices Committee has been furnished to PETROLEUM PROCESSING by Harold M. McCarthy, instrument engineer, Standard Oil Development Co., Linden, N. J. It follows (in part):

The objectives of the Recommended Practices Committee, which was formed in the Fall of 1946, were defined: "To study technical practices in instrumentation; to prepare and recommend uniform practices where adoption of such uniformity would simplify work and facilitate general understanding, and to promote their general adoption."

The scope of the committee's work is confined, in general, to the study of technical practices of an engineering nature. Research, design, and development of new equipment or materials or projects of similar nature, are not considered a function of this group. Suggestions or assistance along these lines are passed to other technical committees of the Society or to outside organizations.

The structure of the Committee is set up to limit the membership to a maximum of 25 instrument engineers, who are actively engaged in the field of instrumentation and automatic control. The Chairman is selected from this group. Each member is Chairman of a Subcommittee.

At the present time, 15 subcommittees are actively engaged on the following developments for recommended practices:

RP-1: Thermocouple and thermocouple extension wire standards.

RP-2: Head type meter auxiliaries.

RP-4: Control valves and bypass manifold installations.

RP-5: Engineering flow plan symbols.

RP-7: Pneumatic pressure tests.

RP-8: Outside instrument protective cabinets.

RP-9: Instrument tubing.

RP-11: Handling of mercury.

RP-12: Instrumentation for hazardous locations.

RP-13: Instrumentation for corrosive services.

RP-14: Primary elements for head meters.

RP-15: Head meter installation calibration and piping.

RP-16: Variable area meters.

RP-17: Survey Committee on plant type analytical sampling systems.

RP-18: Signal and alarm systems.

Any individuals with an interest in any of these projects are directed to contact Chairman W. H. Fortney, Humble Oil & Refining Co., P. O. Box 3950, Baytown, Texas.

strument components and the control board has not complicated repairs. Instruments built on a unit construction basis speed up replacement of parts and transfer the repair work from the field to the shop.

Trend Analysis Difficult

The technique of analyzing trends is somewhat more difficult than for conventional systems since the controller and recorder are at separate locations. In anticipation of such problems, Sohio has provided snap coupling test connections in the transmitted and controlled air lines. These connections have been centrally located behind the board to permit the instrument man to work without interfering with the function of the operator.

The company definitely plans to continue using graphics. The new Thermofor catalytic cracking unit being installed in the Cleveland No. 1 Refinery will be supervised by a graphic (shown in the photograph on the first page of this article). The rectangular black panel with small signs in the center of this new graphic panel is an alarm system to show conditions existing in the process units adjacent to the new TCC unit. It indicates high or low level in such vessels as the tar pot, feed accumulator, gas and water separators, boiler feed water, tar cooler water, synthetic crude tower bottoms, etc.

In the months since Mr. Bowers' paper was written some additional experience has been accumulated. One other shortcoming to the system which the company solved was the confusion caused by using the output air of a controller as a level or other control board indicator. When it becomes necessary to operate with narrow proportional bands or if plant throughputs decrease the gages will not be a true or even satisfactory indication. With a narrow band the indicator will oscillate too much. With reduced throughputs the gage will show too low (or even a zero) reading. At first the operator will be alarmed by this but later he will tend to ignore it altogether. Eventually he might even overlook a low level when it really indicates trouble.

For level instruments the solution seems to be to use a dual pilot or equivalent. This has been done in two instances and is being considered

Discussion following the three papers brought out a number of interesting factors regarding the use of graphic panels. First space on conventional panels could be saved by placing the larger type instruments three-high instead of two-high. That creates some difficulty in obtaining readings of course. Second even more space could be saved by using the new small size instruments on a conventional panel without a flow diagram. However, the pictorial diagram's advantage in handling upsets would probably outweigh the additional space-savings possible by that arrangement.

Some instrument engineers believe the chief problem of close control and transmission lag in the long lines will be overcome by better controllers and improved valve operators. There are others who feel the day of using air as the transmission medium is about gone, and that electrically-actuated components will replace pneumatic control. They believe the incipient hazards of electrical operation because of flammable atmospheres can be overcome. In addition, electricity offers a possibility of using a single transmisssion wire for many different signals at the same time by varying the frequencies. It was completely apparent from the opinions presented both at the discussion and throughout the week in informal talks that the graphic panel's disadvantages are far outweighed by its advantages as a process control tool for the modern petroleum processing plant.

Dial System Monitoring

The scheme for using a telephone-type dial system for process monitoring was described in a paper by E. J. Grace, Jr., chief instrument engineer, Sun Oil Co.[8] Most of the systems he discussed are in operation at Sun's Toledo refinery. The systems include means for indicating at the central control room the identity of the particular unit connected to the measuring or controlling device using a feed back signal from the remotely located unit. Six systems described included:

1—A dialing system for 1000 points using a feed back indicator.

2—A scanning system for 1000 points using an indicator with an alarm.

3—A continuous indicating system using one measuring device for 20 indicated points.

4—A survey system that permits recording any combination of 10 of 100 points using a dial for selection.

5—A control point setting system that will permit remote setting of 1000 controllers with one master unit.

6—Remote operation of electric motors, valves, etc. using a single push button station or controller.

Sun has not had any service adjustments on any of the equipment since it went into operation. Some units have been in constant use for 18 months in hazardous and corrosive atmospheres without any electrical contact trouble. A safety feature is that all switching is accomplished with the operating contacts carrying no load or potential. "Savings in wire, conduit, fittings, labor, and panel board space becomes appreciable in large installations of 200 points or more, using this system," Mr. Grace said.

Radium to Measure Catalyst Level

Another unique instrumentation installation at Sun's Toledo refinery is the use of an atomic energy-operated device for measuring catalyst level in a Houdriflow catalytic cracking unit. This was described in a paper by O. W. Graham, president, Instruments, Inc., and E. J. Grace, Jr., Sun Oil Co.[9] The instrument, called a "Gagetron", can be used in other types of catalytic cracking units and was completely described in an article in the Sept. 1950, PETROLEUM PROCESSING.[6]

It operates on the principle that gamma radiations from a radioactive source—in this case, radium salts—vary in proportion to the density of any material between the radiation source and a detecting means such as a Geiger counter. When used on a catalyst vessel, where the density of the catalyst remains constant, the variations in gamma rays becomes a function of the thickness—or level—of the catalyst bed.

The instrument itself was developed by Mr. Graham. Its adaptation to some of the difficult problems of level measurement in the Houdriflow unit is the result of work by Mr. Graham and his associates in cooperation with Mr. Grace of Sun and D. B. Ardern, Houdry Process Corp.

An interesting future possibility in the application of the Gagetron was pointed out by Mr. Grace in the discussion period following the paper. The variations in radiations are also a function of the atomic number of the material through which they pass. This suggests that the instrument might be set up to obtain readings on a fluid passing through a process line. The thickness of the pipe walls is constant, the thickness of the fluid is of course constant, and the density can be maintained constant by precise control of the flow. The device would then be capable of a direct measurement of the atomic number of the fluid in the pipe line.

Employing radium in the refinery necessitates some added safety precautions in handling and storage. Personnel at Sun's Toledo plant developed a special storage pit (see photograph) in which the radium can be safely kept when it is necessary to remove it from the vessels for any reason. On the process unit, the radium is inserted through conventional thermo-wells, contained inside of a metal rod which has been inserted into the wells. The rods are transported to and from the process unit in the lead-lined cylinders shown in the photograph, and dropped into the underground wells or pits in the concrete block.

Many New Instruments

New instruments and equipment displayed in the Conference Exposition Hall represented many different approaches to the problem of improving plant instrumentation. Some of these new products have already been reviewed in PETROLEUM PROCESSING's "What's New!" section. Others will be reviewed in this and future issues.

Widespread interest was shown in a number of instruments for automatic, continuous analysis of fluid streams in the detection of oxygen, hydrocarbons, etc. Most of these devices had been introduced at previous ISA Show, but improvements in their capacities, qualities, etc., were notable at this year's exhibit. Spokesmen for a number of oil companies told PETROLEUM PROCESSING they are doing extensive research and study on the possible applications of these instruments in refining units. Companies known to be carrying on active development work include Phillips Petroleum Co., Shell Oil Co., Gulf Oil Corp., and Esso Standard Oil Co.

An interesting new development in one type of gas analyzer was that exhibited by Permutit Co., Ranarex Instrument Div. It consisted of a conventional Ranarex specific gravity gas analyzer combined with a standard Fischer & Porter pneumatic transmitter.

The standard transmitter is installed in the Ranarex case and is attached to the indicating linkage. It converts indicator position to a corresponding output air pressure signal which can in turn actuate any conventional indicating, recording, or controlling instrument in terms of specific gravity changes.

Remote reading tank gaging systems for multiple tank systems were shown in a display by Shand and Jurs Co. An interesting feature of this device is the inclusion of simultaneous indication on the same panel of the temperature at each tank in the system. The instrument operates electronically. Tank level is picked up as usual by a conventional float and tape. Then tape movement is transmitted by means of a sprocket wheel to potentiometers. Current changes are transmitted by wire to a Brown "Electronik" precision indicator which utilizes the balanced Wheatstone Bridge principle.

Another interesting product on display at the ISA Show was not actually an instrument yet it attracted many instrument men. It was an engraving machine for making small instrument panel signs, legends, symbols, and the like. Three different manufacturers showed equipment of this type all of which operates on the principle of the pantograph.

The average refinery uses hundreds of these small instrument panel signs. Because of continuing alterations and changes in processes, the turnover and demand for new and replacement signs is quite high. For this reason it may pay an instrument department to purchase an engraving machine and make its own signs rather than buy them from an outside source.

One refinery instrument department head told PETROLEUM PROCESSING his company already has these machines in two refineries and he himself has authorized the purchase of a third for his own plant. On the basis of an approximate cost of $300-350 for a machine, he has estimated it will pay for itself in eight days. It will take one man about a half-day per week to fulfill the demand for new signs, and that can be a night crew man who is on stand-by duty and therefore idle part of the time anyway.

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10 Ways to Stop Losses In Lubricating Plant Equipment

From a Report by L. F. JAHNKE*
Socony-Vacuum Oil Co., New York

Startling losses frequently occur through inadequate and improper lubrication of the machinery and equipment in a refinery. A checklist of 10 significant factors is presented as a means for determining the efficiency of lubrication methods. A pattern is also given for installing a practical lubrication system, based on the needs of the individual plant.

A PRACTICAL approach is presented to the problem of securing better lubrication of the equipment within the refinery. The approach requires that management examine a number of factors, all readily visible or available within the plant, as a means for estimating the efficiency or cost of the practices currently existing.

The ultimate aim is to improve operation of the plant and save money—to enable the refinery to stay competitive in its costs.

Included in the costs and practices involved are part of the costs of replacement of anti-friction bearings, bearing metal, worn parts, sometimes wornout machines, rewinding of oil-soaked motors. Also included are the costs of storage, inventory and distribution of lubricants, and the time spent in their application. Then there is a heavy charge for maintenance labor, both direct and indirect. These costs may greatly exceed the cost of wasted lubricant, or in fact the entire oil bill. In addition, down time, or possible down time, as the result of faulty lubrication may outweigh all the other factors combined.

These costs are insidious. Dispersed into hundreds of small items, they appear in a score of different disguises, many not recognized as connected with lubrication. They escape attention because no one of the individual items is large enough to attract notice. The true picture only begins to take shape when it is viewed from a number of angles.

Ten factors are presented as a means of check of lubrication practices in effect in the individual refinery. The check is not difficult to make and it can be the basis for an estimate of the cost or efficiency of the methods currently in use.

1 Is the smallest practical number of different lubricants in use? One refinery uses 60 different lubricants; another does nicely on 15. While no two operations are exactly parallel, the larger number can surely be reduced by half. If 30 grades can be eliminated, the number of open packages, floor space occupied, transportation required, chances of confusion and possible resulting damage, certainty of waste, and loss of time are greatly reduced. It is an exceptional case when the number of lubricants in use cannot be greatly reduced to advantage.

2 Is the minimum amount of grease and oil used? It is a fallacy that the use of a "little more oil" will save trouble. Actually, lubrication troubles and maintenance are greatest in plants where machines and surroundings drip oil. Operators mistake oil on the outside of the machine for assurance the inside is getting what it needs. Also, in some types of machines too much oil is damaging, and in a few too much oil can cause an explosion. Excess lubricant under foot is often a safety hazard. Lastly, the direct waste of lubricant can amount to a sizeable figure. Machines and records should not show excessive use of lubricants.

3 Are the right lubricants in use at every point? If the lubricants used are more expensive than necessary, waste is encurred. If they don't do the job, it is an even greater cost in repairs and maintenance. Unless it can be shown that operators are strictly following recent and qualified recommendations, there is a strong presumption of a number of wrong lubricants in use.

4 Are charts of recommended lubrication practices posted and followed? Without charts, the use of the proper lubricants becomes increasingly doubtful as time passes or men change jobs. The posted charts should include information on how often, how much, where, and anything else the operator needs to do a good lubrication job. It is also necessary to check from time to time to see that the charts are followed.

5 Is there a system for adequate education of all those who have any responsibility for lubrication? This goes beyond the simple directions that can be posted on a chart. The necessary people should understand why certain practices must be set up and adhered to. All too often those who have to make decisions or give directions on lubrication get into trouble because of lack of knowledge. Mistakes at this level can be multiplied by many machines or crystallized into a wasteful policy continuing for years. Inadequate knowledge of grooving of bearings, fitting of bearings, installation of anti-friction bearings, oil reclamation, atomizers, servicing of devices etc. also can cause trouble. Much of this has to do with people who are not directly concerned with applying the lubricant. It is shop and maintenance men who must be reached here. The saving is in less maintenance, fewer repair parts and in use of less lubricant.

6 Is there a well-organized central warehouse for lubricants, together with good local storage facilities? No one plan is the solution for all refineries or even all parts of one refinery. However, in most places the storage and distribution of lubricants has never been given a sound overall analysis by someone who knew what should be done and how to do it. A sound plan, tailor-made at every point, can reduce the number of open packages, floor space occupied, transportation required, the use of wrong products and waste through spill, drip and contamination, as well as time spent in storing, drawing and handling at point of use.

7 Are well-planned records kept of consumption, application and oil changes? Without these there is no way to detect the increased use of lubricant resulting from a mechanical fault that may in itself become expensive if not caught in time. Nor is

* This article is a condensed version of a paper presented at the Petroleum Mechanical Engineering Conference of the American Society of Mechanical Engineers, in New Orleans, Sept. 24-28, under the title "Refinery Lubrication—A Management Problem."

there any way to determine whether the application is adequate, or 10 times what it should be. Without records, also, oil batches can run too long and damage machines, or be changed when practically new and thus waste oil and time.

8 Are dirt and contamination prevented from entering lubricants and bearings? In many refineries there are open lubricators, open barrels, barrel pump drains, open oil containers, open grease packages and application devices — all collecting blowing dirt.

9 Is there evidence of wear and trouble resulting from faulty lubrication? If worn pump rods, liners, gears, engine and compressor cylinders, worn or discarded bearings, motors on the shop floor with oil-soaked windings, or other evidence of faulty lubrication come to attention in the courre of a year, it may be evidence of faulty lubrication. Often it may be hard to separate normal from abnormal wear and, unfortunately, sometimes abnormal wear has existed so long it is no longer recognized as such. Careful analysis of visible or recorded evidence of wear, coupled with a knowledge of what can be done, will often save large sums on repair and maintenance.

10 Is there a soundly organized plan in the refinery for control of lubrication? This is perhaps the nub of the entire problem. In most refineries, supervision of lubrication is an incidental responsibility of 10, 20 or more people, distributed through the operating, storehouse, power and maintenance departments. Because the responsibility is so split up, no one is in a position to do a sound job. Because of the departmental lines, there usually is not much effective coordination of effort.

Is it practical and easy to install improved lubrication practices in a refinery? It is not easy and, once taken care of, it cannot be forgotten, but it is practical. Here's a suggested way to go about it, provided the preliminary survey outlined above shows money can be saved:

First, it should be treated as a single, integrated problem. That includes storage, wall charts, education of operators, selection and use of correct lubricants, records, housekeeping, and any other interrelated factors. This requires an adequate survey of all elements of the problem. For this task a lubrication engineer is needed. He may be one of your own people, if your company supplies this service to industrial plants, or an outside lubrication engineer can be used.

His first task will be to assemble a list of all the brands and grades of lubricants used in the plant, their cost, where each is used, on what machines and in what quantity. This list will probably show an excessive number of grades used, different products used for the same purpose in different parts of the refinery, a number of brands used only in small amounts or in one or two places, and some expensive products used where they are not necessary.

$$$,$$$ Savings Possible

"Suppose the preliminary survey brings out that money can be saved by improving the refinery lubrication practices. How big a saving is possible? Some time ago this subject was examined by a group of 30 experienced men and no objection was taken to the estimate that a major company in all its refining operations might save a sum in six figures by better lubrication practice. For a single refinery saving would be somewhere in five figures."

—*L. F. Jahnke.*

The lubrication engineer may then make out a tentative list of products that can be used throughout the refinery in a reasonably consistent pattern. This list may be but a fraction of the list in current use. It should show the best product for each critical service but indicate inexpensive lubricants where the service is easy and quantities large. Every effort should be made not only to hold down the total number of grades used, but also to use the fewest grades possible in any one department or location.

Armed with his lists, the lubrication engineer may then examine the machinery in the plant, department by department, to check the validity of his tentative recommendations. He will want to talk to operators, oilers, and everyone familiar with the lubrication history and problems of the equipment.

The examination will probably bring out a number of inaccuracies in the list of brands in use and the quantities consumed. It may uncover cases where expensive oils are being drawn from circulation systems and reused for hand oiling. It may also bring out cases where personal bias is the only justification for a grade in use. On the other hand, the examination may disclose factors that permit or require modification of the tentative recommendations, such as the age of the machinery or unusual operating conditions.

Finally, however, the lubrication engineer will arrive at a minimum list of products, along with recommendations of where they should be used. Sometimes management is content to distribute this information and do nothing more, in which case the results usually are negligible. Operators do about what they did before, or gravitate to other lax practices.

It is better if the engineer goes on and adds complete recommendations on devices, oiling frequency, batch changes, methods of application, rates of feed, housekeeping and anything else that tells operator or oiler how to do a good job. The lubricant recommendations and the instructions should be typed out on charts and posted where they apply. They won't do much good if kept only in a desk drawer in the head office.

A study should also be made of the main oil storage house and of all local areas where lubricants are kept. A plan should be developed for a balanced, integrated system of storage and handling of barrels and packages. This may involve racks, pumps, spill pans, hoists, wall signs and housekeeping standards. The lubrication engineer can give help on these.

A simple system of lubrication records should be laid out, designed to locate and spotlight any waste or possible saving of lubricant. Thought should also be given to what training is necessary for the various levels of operators that have to do with lubrication. Some may need no more than a few moments' training, while some few conceivably may need days or even weeks. Maintenance people who fit bearings, repair machines and inspect and adjust them should be included in the training.

One step in the procedure for working out improved lubrication practice for the plant is to develop an organized plan for permanent control. The earlier this is done after the lubrication engineer has made his survey of the plant, the less likelihood there is of his services being wasted. If it is known who is to head up the lubrication program, it will be helpful for him to go through the earlier steps with the lubrication engineer. There is no single best way to organize lubrication control. It should be suited to the organization.

Wherever the responsibility is placed, good management principles should be followed. In the case of a single individual, he should be held accountable for trouble and equally given credit for good operation, improvements made and money saved. He should be responsible for the budget for lubricants and everything relating to their storage, distribution, application, reclamation or filtration. He should organize whatever training seems to be indicated. Whoever is chosen must be given the necessary time for the work and the requisite authority.

TEXACO
LUBRICATION CHART

PREPARED FOR

The Texas Company
Refining Department
Port Arthur Works

A Lubrication Engineering Service of The Texas Company Presented _____ 194__

PUMPHOUSE NO. _____ DEPARTMENT

EQUIPMENT-PARTS TO BE LUBRICATED — LUBRICANT RECOMMENDED

CENTRIFUGAL PUMPS - STEAM TURBINE DRIVEN

PUMP BEARINGS - (GREASE LUBRICATED) (TRADE NAME)

Check bearing temperatures - hourly

Add approximately ½ oz. grease every 14 days

Grease fittings should be free of dust and dirt when adding grease

NEVER PAINT GREASE FITTINGS

Drain - flush and refill every 6 months

DO NOT OVERLUBRICATE - Too much grease causes bearings to overheat

TURBINE BEARINGS (TRADE NAME)

Check oil level hourly - Add oil as needed

DO NOT CARRY TOO HIGH AN OIL LEVEL

Drain - flush and refill every 30 days

COUPLINGS - GEARED (TRADE NAME)

*Check and relubricate every 60 days

*Machinist should be scheduled to do this work

Adhere to this chart. Order lubricants by brand name or number shown above.

LUBRICATION CHARTS posted near refinery equipment to be serviced assist operators in applying the correct lubricant properly

A plant lubrication program is described as organized in a large refinery processing around 200,000 b/d of crude. Headed by a trained lubrication engineer, his department handles and distributes all supplies used in lubricating the plant equipment, in addition to prescribing the lubricant and supervising its application.

Special Staff Prescribes, Follows up Lubrication of Refinery Equipment

From a Report by* **FRANK M. LEVERETT**
Power Engineer, The Texas Co., Port Arthur Works

THE equipment requiring lubrication in a large refinery covers probably as great a variety as may be found in any industry. It ranges from such delicate mechanisms as instruments for indicating and recording pressures, temperatures, rates of flow and so on, to steam locomotives, large turbo-generators, earth-moving apparatus and the like. It includes such machinery as pumps, compressors, blowers, steam and gas engines, steam turbines, cranes, elevators, conveyors, automotive equipment and machine shop equipment.

Whenever refinery equipment is installed and put into operation, careful attention is given to the manufacturer's recommendations for its lubrication. These recommendations are strictly adhered to, insofar as they apply to the kind of lubricant desired, viscosity or consistency, amount of lubricant to be used, frequency and method of application.

It is, of course, one of the very important functions of a manufacturer of lubricants such as ourselves to work closely with all manufacturers to the end that the lubricants

* This article is a condensed version of a paper given at the Petroleum Mechanical Engineering Conference of the American Society of Mechanical Engineers, in New Orleans, Sept. 24-28, under the title "Lubrication of Refinery Equipment."

we furnish and the lubrication recommendations we make are not only adequate and satisfactory in the equipment but also acceptable and approved by the manufacturer.

Many occasions arise, however, where it is not possible to make a satisfactory recommendation for lubrication until the full operating conditions of the equipment have been determined, so the instructions of the manufacturer must of necessity be very general, or for average conditions. The general instructions then serve only as a guide for the final selection of the lubricant.

The same equipment when used in different refineries, or even in different parts of the same refinery, may handle entirely different liquids (acids, solvents, alkalies, etc.), or solids such as fullers earth, diatomaceous earth, catalysts, lime, etc. Or such semi-fluid materials as asphalt, grease, soap, slurry of clay and water or oil, and all of these at a great variety of tempertaures. Or compressors may be called upon to handle wet or dry gases, which may or may not be corrosive, and such ordinary products as air or flue gas or propane. Under such variable conditions the refinery lubrication engineer must draw upon his own background of experience, or present his problem to someone with the necessary background or knowledge. This may entail the services of laboratory technicians, or men who have had similar problems to solve in other industries, such as the industrial sales engineers of lubricant suppliers.

The conditions under which refinery equipment has to operate cover a wide range. For example, some of the laboratory equipment is required to operate at —50°F. to —100°F. while other machinery may be found in operation with surrounding temperatures in excess of 150°F. Some equipment, such as is encountered in clay handling and burning, operates in extremely dusty atmosphere, while cooling tower induced draft fans and drives operate in very humid atmosphere. In a refinery a large percentage of the equipment is generally located outside of buildings, where it is directly exposed to all prevailing atmospheric conditions.

Separate Lubrication Department

At the Port Arthur works of The Texas Co. a separate lubrication department has been set up, under the direction of a competent lubrication engineer. This department is charged with the responsibility of prescribing the proper lubricant used in each individual case, and then following up to see that the prescribed lubricant is properly applied. It also handles the distribution of all lubricants for plant equipment.

Only branded lubricants in original packages are supplied to the departments using them, and furnished from the company warehouses in the refinery. This enables accurate accounting of lubrication expense, familiarizes the personnel with trade names and packages, and prevents the substitution of inferior or otherwise unsatisfactory lubricants. This latter usually happens if operators are allowed to select and apply indiscriminately the nearest available product being processed in the plant, or to purchase or secure products in accordance with their usually inaccurate ideas of the type of lubricant required.

So Near—Yet So Far

The mere fact that a complete line of lubricants is manufactured within a refinery has little bearing on the proper lubrication of equipment in the plant. It means only that the required grades of lubricants may be more readily available.

—Frank M. Leverett

To assist the operator in applying the prescribed lubricant properly, lubrication charts are made up and posted at convenient locations near the equipment requiring lubrication. The charts show the trade name of the prescribed lubricant, quantity to be used, frequency of oil change and other pertinent information.

The distribution of lubricants within the refinery is assigned to the lubrication department for several reasons. First it assures getting the correct product; second, it gives a check on the quantity of lubricant consumed; third, it assists in determining the quantity of the various grades of lubricants to be requisitioned. It has been found more satisfactory to requisition once every week or two the lubricants required to supply the entire departmental needs, in order to cut down the number of small orders.

Probably one of the most serious problems confronting the lubrication engineer is that of preventing contamination of lubricants after they are delivered to the various points of consumption. This requires constant checking to make sure that the dispensing equipment is kept clean, that covers are kept on grease containers, bungs kept in oil drums and covers kept on lubricators. The problem is most acute where the equipment is scattered over a wide area and where the operator in charge is primarily interested in other operations which take precedence over supervising plant lubrication. In order to assist operators in keeping their lubricants and the equipment for applying them free from contamination, a special cabinet was designed. It is equipped with steam coils in order to keep heavy oils fluid in cold weather. Very little difficulty is encountered in handling the lubrication of equipment in power houses, pump houses, compressor stations and other installations where the primary duty of the operator is to watch over the mechanical equipment within the building.

Three Lubrication Problems

Typical examples of difficult refinery lubrication problems are outlined below:

1—Several worm gear speed reducers were installed on a water cooling tower to drive the induced draft fans. The speed reducers were required to operate 24 hr./day under full load conditions. Location of the fans and construction of the cooling tower made it difficult to service the speed reducers except at rare intervals. Moreover, the air surrounding the gear boxes is relatively warm and supersaturated with moisture. Compounded cylinder oil was used to lubricate the speed reducers, as is usually recommended by the various gear manufacturers.

Within a few weeks after initial operation of the cooling tower, trouble was experienced due to badly worn gears. After considerable correspondence with the manufacturers several changes were made. First, all the gear bases were drilled and tapped so that the sludge and grindings could be thoroughly flushed out when changing oil without dismantling the entire unit. Second, an oil level inspection line was run to an accessible location where frequent level checks could be made. Third, a lead base lubricant was supplied which, on the basis of previous experience, should prove a more satisfactory lubricant than was originally recommended. After 14 months of continuous operation, the gears have given trouble-free service and the lubricant has shown very little signs of deterioration.

2—Several reciprocating type pumps were installed to operate in connection with furfural solvent refining processes. Their cylinders were lubricated with the usual grade of lubricant prescribed for this service but, after operating a short time, it was found that the piston rings and valves were badly fouled due to reaction between the vapors handled and the lubricant. Several different types of lubricants were tried before one was found which gave satisfactory results and this grade is now specified for all vacuum pumps in this service.

3—A 150-hp ball bearing induction motor installed to drive a pump began giving bearing trouble shortly after being installed. After several renewals of the bearings and trying different grades of lubricants, the trouble was corrected by installing insulated bearings, the trouble having been due to electrolysis rather than a failure of lubricants.

How to Figure Surge Capacity When Using Level Controllers

By JOSEPH CONISON, Instrument and Control Engineer
The Fluor Corp., Ltd., Los Angeles

Adequate surge capacity is needed in a processing unit to absorb sudden changes in liquid flow—if upsets in plant operation are to be prevented. This article developes formulas for determining how much surge capacity is needed, based on the maximum change in rate of flow that may be expected with different types of level controllers.

THE liquid level controller as applied to many petroleum processes is fundamentally a flow controller operating in conjunction with the rise and fall in level within a surge vessel, reboiler, etc. The ultimate purpose of the surge capacity is to *absorb* sudden changes in liquid flow to the vessel, thereby preventing upsets to subsequent plant processes. Typical applications as found in petroleum processes involving smooth and regulated flow rates are:

1. Feed to a fractionating column
2. Flow to a process heat exchanger
3. Feed to a blending tank

In Fig. 1 is a typical instrument arrangement to control the overhead and bottom products from the fractionating column due to fluctuations in feed rate and/or feed composition; external changes in temperature, wind velocities, barometric pressure, etc., that may in any way alter the control temperature or pressure of the system.

If the feed is cold and the rate to the column is suddenly increased, the equilibrium established in the column can very easily become upset and, before the instruments can regain control, a large quantity of "off-specification" product can leave the column. What is generally overlooked is the time lag due to the operating changes reaching the instruments; the lag due to the instruments actuating the valves; and the lag required for the control valves to reach the new positions to compensate for the new conditions. The greater the changes of feed rates imposed on a column, the longer will be the time required for the instruments to regain complete control; and the smaller the changes in feed rates, the less will be the time.

One operating variable, namely feed rate, can be regulated by means of proportional or proportional-plus reset type level controllers and a surge vessel that is adequately designed for maximum changes in rates of flow into the vessel.

The Proportional Controller

The proportional type level controller is an instrument such that the output air pressure to the control valve can be regulated on the basis of the deviation of the indicating pen from the control point. The relationship between the output air pressure and level in the vessel is linear. The units of regulation are in terms of percent throttling or units of sensitivity.

For the benefit of simplicity, we shall clarify and limit the following terms and conditions in the proceeding discussion:

Width of instrument scale—4 in.

Output air pressure from level controller—3 to 15 psi.

Air pressure required to stroke valve 100%—3 to 15 psi.

Direct operating instruments, namely increasing air output from instrument on rising level, and increasing air to open valve.

Throttling range is the percent of the scale deviation of the indicating pen from the control point necessary to stroke the valve 100%. For example, if the indicating pen is 4 ins. away from the control point and the instrument is set at 100% throttling, then the instrument will theoretically transmit 12 psi. additional air to the valve. If the indicating pen is 2 in. away from the control point with the same setting, then the instrument will transmit 6 psi. additional air to the valve, etc.

Sensitivity(2) on the other hand, is the output air pressure change (psi.), transmitted by the instrument per inch deviation of the indicating pen from the control point. If the instrument is set to control at 1 psi. sensitivity, then the instrument will transmit 1 psi. additional air (above that at the control point) to the valve per inch deviation. If set at 3 psi. sensitivity, then the instrument will transmit 3 psi. additional air to the control valve per inch deviation between the indicating pen and the control point.

Throttling Range:

$$T = \frac{I \times 100}{L} \qquad (1)$$

Meet the Author

Joseph Conison, instrument and control engineer, The Fluor Corp. Ltd., has a degree in chemical engineering and carried on post graduate work at the University of Cincinnati and in refinery engineering and process control at U.C.L.A. Extension. From 1934 to the present he has been engaged in chemical and process engineering and plant design work, having joined Fluor in 1947. He specializes in process engineering on natural gasoline plants and, as instrument engineer, on line sizing and specifying of instrumentation and control equipment for all types of plants.

where:

T = percent throttling range
I = Inches of pen deviation from the control point necessary to stroke the valve 100%.
L = Width of instrument scale, inches.

Sensitivity:

$$S = A/I \qquad (2)$$

where:

A = Air pressure required to stroke the valve 100% = 12 psi.
= 12 psi.

therefore:

$$S = \frac{A \times 100}{T \times L} \qquad (3)$$

or:

$$T = \frac{A \times 100}{S \times L} \qquad (4)$$

Fig 2 is a conversion curve between throttling range and sensitivity based on a 4 in. scale and a 3-15 psi. output air pressure range. Note that as sensitivity increases, % throttling decreases to zero at infinite sensitivity.

Referring to Fig. 3, we shall assume that the instrument is set at 50% throttling (the optimum sensitivity[1]), the level to be controlled at "c", the center of the instrument's range, and the fluid entering and leaving, Qn gpm., equals 50% of the maximum rating of the valve. If the inflow increases, the level will rise deviating the indicating pen from the control point and in turn the instrument will increase the air to the valve until the flow from the vessel equals the flow into the vessel.

If the inflow increases until the capacity of the valve is reached, the level attained will correspond to "b" in Fig. 3. Furthermore, if the inflow increases beyond the capacity of the valve, the level in the vessel will rise above "b" and the increase in volume will be equal to:

$$\Delta V = (F_i - F_o)\theta \qquad (5)$$

= gallons

where: F_i = gpm. into the vessel.
F_o = gpm. leaving the vessel.
θ = time in minutes

Reversing the process, if the flow decreases below Qn, the level in the vessel will drop, and as a result, the instrument output pressure to the valve will decrease until flow from the vessel equals the flow into the vessel. When the level drops to "a" at zero inflow, the valve will close, and remain closed until the flow into the vessel continues once again.

In summation, when using a proportional controller at the optimum setting, the level in the vessel will be determined by the ratio of the inflow to the maximum design flow between the limits "a" and "b". By means of adequate surge capacity, rangeability of the level controller, and selection of the control valve, the flow to subsequent units can be regulated to give any desired rate of change of outflow based on any maximum incoming flow.

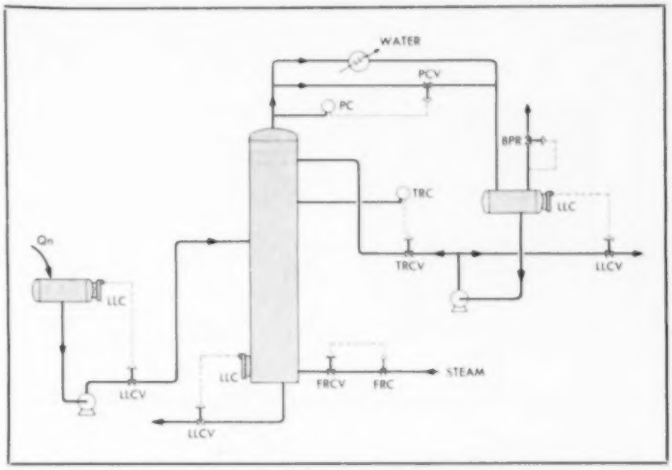

FIG. 1—Typical instrument control for a fractionating column

If the level controller is adjusted so that it is sensitive between the limits "a" and "b" (a level change of "h" would actuate the valve 100%, from 0 to Qm gallons per minute), and the normal rate, Qn, equals $\frac{1}{2}$ Qm, the surge volume required would be equal to:

$$V = (Qn)^2/R \qquad (6)$$

where: V = surge volume in gallons limited by the distance "h" (equal to the range of the instrument.)
R = greatest rate of change of outflow from the vessel that can be tolerated by the following process unit, in gals./min./min. (generally 0.05 to 0.20 Qn).
Qm = maximum design rate, gpm.
Qn = normal design rate, gpm.

If Qn gpm. are flowing into the vessel when the level is at the midpoint, "c", and the flow is immediately increased to Qm, then in θ minutes, the volume will increase by V_1:

$$\frac{\theta\,(Qm - Qn)}{2} = \frac{Qn}{2} = V_1 \qquad (7)$$

where: V_1 = Volume of vessel between "b" and "c"
= $\frac{1}{2}$ V.

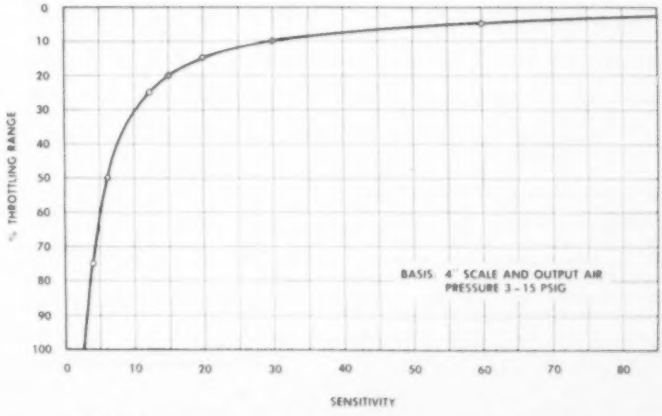

FIG. 2—Conversion curve between throttling range and sensitivity

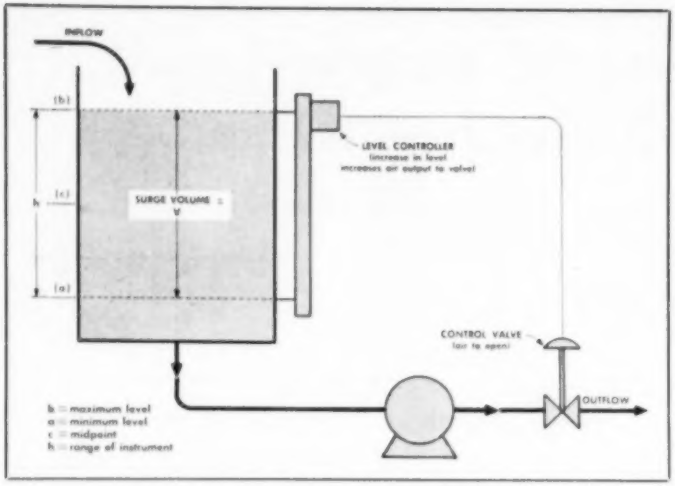

FIG. 3—Level control arrangement

The rate of change of outflow, R, will be:

$$R = \frac{Qm - Qn}{\theta} = \frac{Qn}{\theta} \quad (8)$$

and:

$$\theta = \frac{Qn}{R} \quad (9)$$

as:

$$\frac{\theta\, Qn}{2} = V_1$$

then:

$$V_1 = \frac{(Qn)^2}{2R} \quad (10)$$

and:

$$V = \frac{(Qn)^2}{R} \quad (11)$$

As an example, let
Qn = 25 gpm.
and: R = 0.05 × 25
= 1.25 gpm./min.;
then; using equation (11):
$V = (25)^2/1.25$
= 625/1.25
= 500 gals.

Proportional-Plus Reset Controllers

Units of reset are the number of times per minute that automatic reset duplicates proportional response correction by the difference between the indicating pen and the control point. For example, if the reset rate equals 1, and the pen is positioned to give a 1 psi. change in proportional response, then reset readjusts at the rate of 1 psi./min./1 psi. original change.

A reset type of level controller differs from the proportional type in the respect that it will attempt to maintain the level at the midpoint, "c" with varying flows into the vessel. If flow into the vessel increases, the level increases also, but is gradually lowered to the midpoint again.

Fig. 4 shows the effects of reset response on level control. The overpeak[1] of outflow over Qm amounts to approximately 0.38 $(Qm - Qn)$, and due consideration should be given to the sizing of the control valve mentioned below.

If Qm = maximum inflow
and Qn = normal inflow

then, when using a reset controller, the surge volume required is equal to:

$$V = \frac{(Qm - Qn)^2}{R} \quad (12)$$

where: V = Surge volume limited by "h", Fig. 3.

The maximum capacity of the control valve, Qv, is then equal to:

$$Qm + .38\,[(Qm - Qn)] = 1.38\,Qm - .38\,Qn \quad (13)$$

As an example in determining the surge capacity when using a proportional-plus reset controller,
let, Qn, the normal inflow = 25 gpm.
Qm, the maximum contemplated inflow = 40 gpm.
and limit the maximum rate of change, R from the vessel to 1.25 gpm./min.

Using Equation (12), the surge capacity,

$$V = \frac{(40 - 25)^2}{1.25} = \frac{225}{1.25} = 180 \text{ gals}$$

To size the maximum capacity of the control valve, using Equation (13),
$Qv = 40 + [.38\ (15)] = 45.7$ gpm.

Advantages of the Two Types

1. **Plant Start-Up**—The proportional controller can control automatically from zero flow; whereas with the reset type, start-up has to be made with proportional control and eventually switching over to proportional-plus reset control.

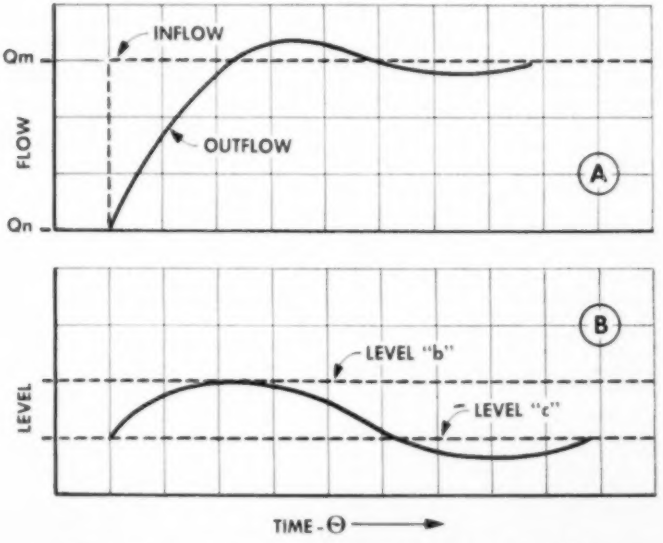

FIG. 4—Characteristics of a proportional-plus reset level controller

2. **Surge Capacity**—When Qn is greater than $\frac{1}{2}$ Qm, then reset will require less surge volume than the proportional type.

3. **Variance in Flow**—Referring to Fig. 3, assume that Qn into the vessel increasese ΔQ gpm. With the proportional instrument, the outflow will increase ΔQ gpm as the level rises in the vessel. With reset action, the outflow will exceed $(Q + \Delta Q)$ gpm, as the level rises, and eventually will equal $(Q + \Delta Q)$ gpm when the level has returned to the midpoint, "c." Therefore, if large and continuous fluctuations in inflow are anticipated, smoother operation can be achieved with the proportional controller.

Selection of Control Valve

To complete the linear relationship between the changes of liquid level in the vessel and instrument air output pressure would require a valve of linear characteristics. One such typical valve is illustrated in Fig. 5. Curve "A" is the "percent flow" versus "percent valve lift" at constant pressure drop; and curve "B"* with varying pressure drop (*derived from data calculated from one of the valve manufacturer's data books). As most flow applications pertain to closed systems, the valve characteristics will simulate curve "B" which is very nearly a straight line from 10 to 90% maximum flow, and changing almost linearly with valve lift.

On the other hand, if conditions warrant the need to control at low minimum and/or at high flow conditions (such as may be found in water draw-off applications of overhead still accumulators in the petroleum industry), then it would be more desirable to use a ratio type of valve as shown in Fig. 6. Referring to Curve "A", 40% of the valve lift controls 10% of the low flow, and 60% of the valve lift can control the 90% of the remaining capacity should occasion arise. This feature is one to be considered when low flows are normal, with the possibility of occasionally large influxes.

The two examples cited above were presented by the writer to stress the importance of the correct selection of the control valve as it too can ultimately affect the rate of change of flow from the vessel irrespective of the type of level controller and size of surge volume in service.

Acknowledgement

The writer wishes to take this opportunity to thank the management of the Fluor Corp. for permission to publish this paper; and Mr. W. H. Williams for his suggestions and comments.

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(1) "Averaging Liquid Level Control," J. G. Ziegler, *Ind. & Engrg. Chem.* Vol. 38, p. 360, April, 1946.

(2) "Optimum Settings for Automatic Controllers," J. G. Ziegler and N. B. Nichols, *Trans. A.S.M.E.*, Nov. 1942.

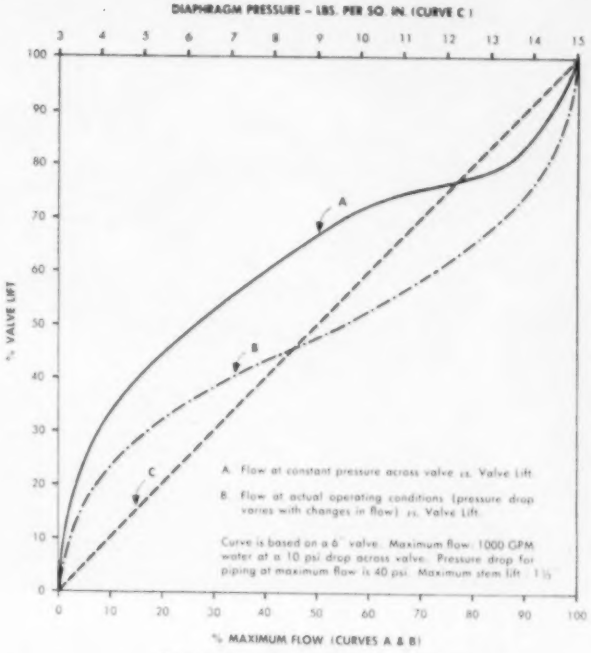
DIAPHRAGM PRESSURE – LBS. PER SQ. IN. (CURVE C)
3 4 5 6 7 8 9 10 11 12 13 14 15
% VALVE LIFT
0 10 20 30 40 50 60 70 80 90 100
A
B
C
A. Flow at constant pressure across valve vs. Valve Lift.
B. Flow at actual operating conditions (pressure drop varies with changes in flow) vs. Valve Lift.
Curve is based on a 6" valve. Maximum flow: 1000 GPM water at a 10 psi drop across valve. Pressure drop for piping at maximum flow is 40 psi. Maximum stem lift: 1½"
% MAXIMUM FLOW (CURVES A & B)

FIG. 5—V-port or linear type valve

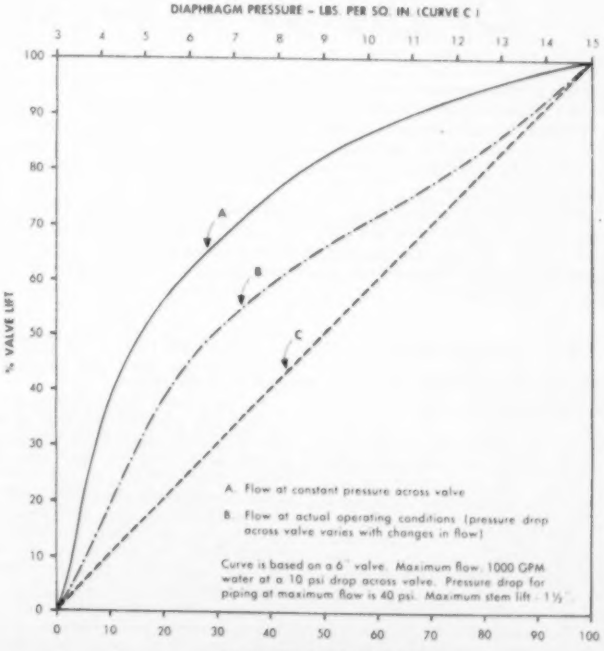
DIAPHRAGM PRESSURE – LBS. PER SQ. IN. (CURVE C)
3 4 5 6 7 8 9 10 11 12 13 14 15
% VALVE LIFT
0 10 20 30 40 50 60 70 80 90 100
A
B
C
A. Flow at constant pressure across valve
B. Flow at actual operating conditions (pressure drop across valve varies with changes in flow)
Curve is based on a 6" valve. Maximum flow: 1000 GPM water at a 10 psi drop across valve. Pressure drop for piping at maximum flow is 40 psi. Maximum stem lift: 1½"
% MAXIMUM FLOW (CURVES A & B)

FIG. 6—Ratio type valve

OIL SHALE PROJECT of the Bureau of Mines at Rifle, Colorado. Demonstration plant is in upper left corner of picture, at end of zig-zag road, 3000 ft. above Colorado River valley and 7½ miles—by road—from the camp in middle background

Shale Oil As a Future Source Of Energy in Western States

Large energy reserves in the form of coal and oil shale exist in the Western states. It is estimated that over 300 billion bbls. of potential shale oil exist in Colorado alone, some of the deposits averaging about 26 gals. per ton. Methods for mining the ore and retorting and refining the oil are being studied by the government, and several oil companies are also interested in these problems.

On the basis of present data it is felt that shale oil represents the best opportunity for supplementing the supply of liquid fuels on the Pacific Coast when needed. It does not appear opportune at present to build commercial plants, but it is logical to continue development work so that the best methods can be arrived at.

By S. H. McALLISTER
Shell Development Co.
Emeryville, Cal.

THE present era has aptly been called the age of fossil fuels, for most of the energy required to run our industrial civilization is derived from coal, petroleum and natural gas. These reserves of energy are unquestionably being utilized at a far greater rate than they are being produced by the processes of nature. While one should not discount entirely the possibilities of increasing our supply from renewable sources based on the current intake of solar energy, such as vegetation, water power, and wind, the fossil fuels represent by far the most convenient and economic source.

At the present time petroleum and natural gas account for 43% of our energy source, coal 46%, and water power only 11%[1]; and our per capita consumption of all these items, particularly petroleum, continues to increase. The corresponding figures for California are approximately 72% for petroleum and gas, 6% for coal, and 22% for water power (see Fig. 1).[2]

It has been estimated that the proven reserves of petroleum in the U. S. amount to about 23.3 billion bbls. of oil[3]. At the present rate of consumption, these reserves would last only about 12 years[4], but new reserves are constantly being found by extensive drilling campaigns so as to approximately balance our present withdrawals. The cost of finding new oil, however, steadily mounts and much of the increase in reserves is due to extensions of existing fields.

W. C. Schroeder of the U. S. Bureau of Mines estimates that by 1955 we may experience a definite shortage of petroleum in this country. Others feel that this prediction is unrealistic and that over 100 billion bbls. of oil[5] will eventually be found in the U. S. No one believes that we are suddenly going to wake up and find that we have run out of petroleum, but all can agree that in the not too distant future we may have to look to other supplemental sources for our liquid fuels. From the research standpoint it is only prudent that we should begin to study the problem now. Foreign oil is a possibility but it cannot be classed as cheap or reliable. Fortunately in the Western states we do have large energy reserves in the form of coal and oil shale.

The federal government shortly before the close of the war set up a synthetic fuel program in which pro-

duction of oil from oil shale was a part. Several of the larger oil companies such as Standard Oil Co. (N. J.), Union Oil Co. of Calif., Shell Oil Co., and Socony Vacuum Oil Co., Inc., are cooperating in this program. A demonstration mine and plant was built at Rifle, Colo., and a research laboratory was located at Laramie, Wyo. The choice of these sites was quite logical as the most valuable of the several oil shale deposits in the U. S. lie in the Rocky Mountain area in the Green and Colorado River drainage basins.

The richest deposit is located in Western Colorado and Eastern Utah, where it has been estimated that a total of over 300 billion bbls. of potential shale oil exists, an appreciable portion of which is in economically interesting concentrations. This known reserve amounting to approximately 13 times the total U. S. petroleum reserve could provide a source for our Western states for years to come[6].

The possibilities of oil from oil shale have occupied the interest of mining engineers in the west for many years and small plants have been set up previously in Utah, Nevada and other sections of the Pacific slope, but with the abundance of cheap petroleum, none of these previous efforts have proved economic.

Oil shale is not a sand saturated with petroleum such as the tar sands found near San Luis Obispo, Calif., but is rather a hard rock, interstices of which are filled with material which, for the want of a better name, is called "kerogen". The rock itself is a magnesium marlestone and when polished shows narrow strips of bituminous filled material interspersed between relatively barren rock. The kerogen is substantially insoluble in most solvents and a large portion of it is probably bound to the rock in a physical or chemical combination. However, the oil can be liberated from the rock by simply heating to a temperature above 800° F.

The vast deposits are thought to be derived from decaying vegetation and algae laid down in shallow intermittent fresh water lakes which covered a large area in the Rocky Mountain basin during the Eocene age. These beds occur in the Green River formation, increasing in richness as the center of the deposit is reached. It has been postulated that the algae producing this bitumen may have belonged to the family of Botryococcus Braunii which is found today in lakes such as Clear Lake, Calif. These small algae secrete an oil similar to tung oil which in the process of aging is transformed and modified into a bituminous resin-like material. Other vegetable matter also contributed to the deposits.

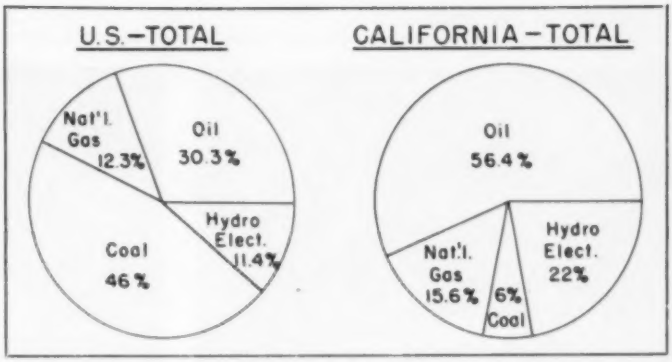

FIG. 1—Energy requirements of the United States and of California

In subsequent geological ages these vast lake beds were capped with igneous rock and other deposits and then eroded by the Colorado River system so that today they appear as high buttes with almost vertical sides where the rivers have cut through. At Rifle, Colo., these cliffs are over 2000 ft. high with the most interesting oil shale being concentrated in the upper 500 ft. The higher grade material (i.e., 20-30 gal./ton) appears in a 70-ft. bed near the so-called mahogany marker which is an easily distinguishable oil shale band. This bed alone would yield nearly 100,000 bbls. of oil to the acre and the total deposits contain over 100 billion bbls.[6]

The demonstration plant located near Rifle is carrying on extensive mining research to determine the most economic method for removing this rich material. At the present time their plan is to recover the rich shale by a pillar type mining operation in 70-ft. high chambers 60 ft. across[5]. The size of these chambers permits the use of very large equipment, such as power shovels and gang drills (Fig. 2) and it has been estimated that the rock can be mined for about 50 cents/ton[5]. The rock is then crushed to small lumps and retorted in batch or continuous stills where the heat required to distill the oil is provided by burning the shale itself.

Several retorting systems are under consideration. Most of the oil thus far produced has been made in the N.T.U. retorts which are batch operated, but continuous retorting systems are currently under investigation, not only by the Bureau of Mines but by several petroleum companies; these appear to offer greater economy and higher yield. Of particular interest in this latter field is the continuous retort already developed to the pilot plant stage by the Union Oil Co. which claims to offer major savings not only in operating cost but in the use of water as well.

In this retort the shale is fed at the bottom by a hydraulic-actuated mechanism, passes upward through the vessel and is discharged as ash at the top. Air entering at the top is preheated by the effluent ash, burns the residual coke in the spent shale and carries the heat thus produced through the raw shale to remove the oil. The vapors from the distillation are cooled by partial exchange with the cold incoming rock and the gas and condensed oils are withdrawn from the vessel[7].

The product obtained by retorting is a heavy distillate type of oil suit-

Meet the Author

S. H. McAllister, native of Utah, received his A. B. and Master's degrees from Stanford University, the latter in 1930. He joined Shell Development Co. as an assistant chemist and became a chemist in 1934. He became Department Head in charge of Applications in 1937 and in 1940 Department Head in charge of Process Development. In 1942 he was made Associate Director of Research in charge of Process Development and Pilot Plants, and four years later he became Associate Director in charge of Petroleum Technology.

Mr. McAllister is a member of several technical societies, has published papers dealing with the manufacture of high-octane fuels and petrochemicals and holds a number of patents. His home is in Lafayette, Cal.

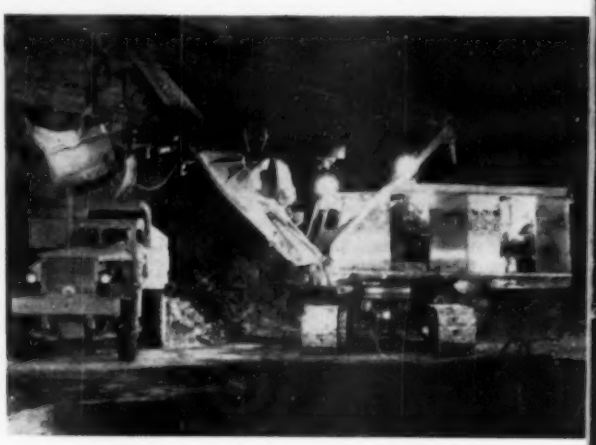

FIG. 2—Oil shale is removed at the Rifle project by power shovels (left) and gang drills (right), operating in underground chambers sometimes as much as 70 feet in height

able for burning under boilers but it must be further refined and treated if the normal line of petroleum products is to be obtained.

In Table 1 is shown an approximate composition of a raw shale oil[5] as compared to a representative West coast crude. It will be seen that it contains little gasoline and light naphtha and is high in nitrogen and sulfur. It is deficient in hydrogen and rich in cyclic compounds and olefins and its refining represents somewhat of a problem. However, it does not initially contain non-volatile asphaltic components such as occur in most of our western crudes. Means for refining this oil and improving the retorting procedures are now under intensive investigation and the picture is changing daily as research opens up new possibilities.

By relatively simple processes the crude shale oil can be made into acceptable bunker fuel oil which would release a corresponding amount of good refining crude for gasoline and diesel oil production and this is probably the way in which it will first be used. To make the normal petroleum products by existing methods it is proposed to vis-break the shale oil to make it suitable for transportation through pipe lines[9]. As the region of origin is a semi-arid country, only sparsely populated, it would then be pumped to some refining center either in the Middle West or on the Pacific seaboard, preferably the latter.

The crude vis-broken oil received at the refinery might be treated by several alternative routes. For example, it might first be coked to remove the materials low in hydrogen and high in nitrogen and sulfur and then be thermally or catalytically cracked or refined to yield gasoline and light distillates. Another method would be to hydrogenate it either before or after coking to make it more nearly resemble a normal refining stock and then refine it in the usual fashion. A flow diagram of the method of refining proposed by Messrs. Roberts and Schultz of Standard Oil Co. (Ind.) is given in Fig. 3[9].

Refining facilities[10] have been installed at Rifle consisting of distilling and viscosity breaking, thermal cracking, reforming and coking units. The treating plant is based on low temperature acid treatment and doctor sweetening.

At this point it might be proper to raise the question of whether oil from shale has better economic possibilities for the future than oil from coal. For the Pacific coast it would appear that it does, but this could be altered by further research progress. Comparisons have been made by Messrs. Murphree, et al, of Standard Oil Co. (N. J.) and Roberts of Standard Oil Co. (Ind.). That of Murphree is shown in Table 2. The coal case is based upon the use of the Fischer-Tropsch synthesis which is the presently preferred method. This process is applicable to either gas or coal and consists of partly burning to carbon monoxide and hydrogen and recombining these components in the presence of an iron catalyst to form a light distillate and water.

The synthesis of gasoline from natural gas, although shortly to be practiced on a commercial scale in Texas[11], does not appear to be of equivalent long term interest as the supply is limited and the raw material is already a premium fuel.

The above figures are considered by some as quite conservative. W. C. Schroeder of the Department of Interior, on the basis of figures obtained at Rifle presented a more favorable view[5]. He estimated that the rock could be mined at approximately 59c/ton including amortization and without profit and retorted to produce a shale oil at Rifle below $2.00/bbl. It would probably cost an

TABLE 1—Comparison of Mid-Continent and L. A. Basin Petroleum and N.T.U. Shale Oil

Type	N.T.U. Shale Oil	Oklahoma City Crude Petroleum	Wilmington Crude Petroleum
Crude			
° API at 60° F	20.4	39.0	25.6
Sulfur, %	0.78	0.14	1.24
Nitrogen, %	1.97	...	...
Pour Point, ° F	80	5	>5
Viscosity, s.u.s. at 100° F	200	45	110
Distillation Summary			
Naphtha, %	3.6	28.4	20.4
Light distillate, %	19.8	25.0	20.7
Heavy distillate, %	25.6	18.6	20.4
Residuum, %	49.8	26.3	36.2
Loss, %	1.2	1.7	2.3
Naphtha Properties			
Tar acids, %	3.6	...	...
Tar bases, %	9.0	...	...
Components:			
Paraffins, %	31	61	80
Naphthenes, %		29	
Olefins, %	50	...	
Aromatics, %	16	10	20

additional 30c or 40c to bring this material to the Los Angeles area. Thus, it would appear, on the basis of present figures, that a heavy type of distillate might be made available in the not too distant future in Los Angeles at about $2.50 per barrel. This price is not so far above current prices as to be visionary or impractical and we may expect further improvements from the work currently in progress in government and private laboratories.

The question is, where do we go from here? The answer is not a simple one, as there are a number of technical problems involved and as usual in such matters there is room for differences of opinion. Certainly when considering a problem of this magnitude, one must take the long range view. Admittedly at the present time petroleum is reasonably cheap and abundant and more will be discovered. Furthermore, in times of peace importing oil may still be cheaper than erecting synthetic plants. On the other hand, it often takes from 5 to 7 years to bring a project from the laboratory and pilot plant stage through to the commercial plant. Construction of plants based on inadequate engineering evaluations and in times of stress is usually wasteful. We should, therefore, take advantage of the present situation to place ourselves in the best possible future position.

The government's program at Rifle has given us a concrete set of figures for the cost of large scale mining. This could not have been done on a laboratory or pilot plant scale, and this has involved such a large expenditure of capital that it is doubtful whether one private company could have justified it. Further effort in the mining field appears justified.

The application of new techniques for large-scale drilling, blasting and handling of shale rock so that we may obtain the lowest mining cost possible is well in order.

Crushing and retorting must also be handled on a sufficient scale to allow the mechanical problems to be thoroughly worked out. Pilot plant retorting equipment similar to that at Rifle appears to be adequate for this purpose and it would be desirable to study a number of other systems and to evaluate them before we freeze the design.

The refining of shale oil comes well within the normal techniques of the petroleum industry and considerable progress can be expected from continuing research. Here also greater progress can undoubtedly be made on a laboratory and pilot plant scale at the present time.

There appears little to be gained by building a commercial plant which would have to sell products at a loss at this time, unless it could be justified on strategic grounds. It would seem that an equivalent amount of money could now best be spent in research; and as the margin between oil from shale and petroleum narrows, the question of commercial plants should be reconsidered.

Perhaps the difficulty in assessing the future course of action in the field of synthetic fuels and shale oil in particular lies in the lack of suitable yardsticks. These projects should be viewed as insurance policies against a future shortage of liquid fuel. The location of these reserves of shale oil are known and they are abundantly available. If we continue to tackle this problem with vision and resourcefulness, we can rest assured that the West will have a liquid fuel supply for many years to come.

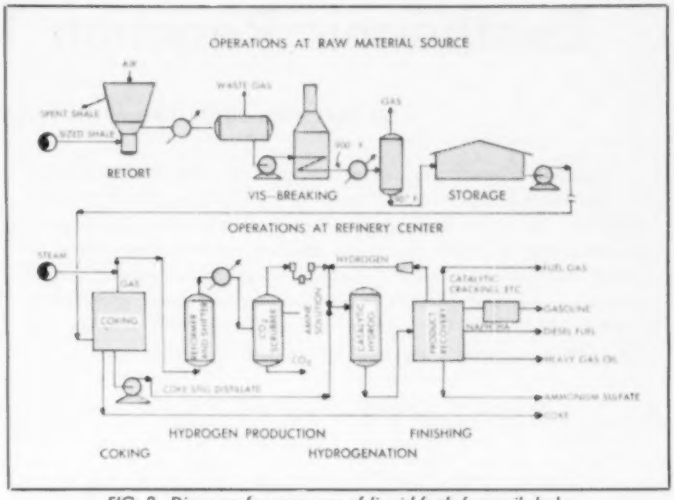

FIG. 3—Diagram for recovery of liquid fuels from oil shale

Acknowledgement

The preceding article was presented originally as a paper under the same title by Mr. S. H. McAllister before the Northern California Section of American Chemical Society, at Berkeley, Calif., and has now been made available to PETROLEUM PROCESSING by the author.

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TABLE 2—Approximate Estimated Costs for Manufacture of 97 Research Octane Number Gasoline

Raw Material	Petroleum	Natural Gas	Coal	Oil Shale
Location	Gulf Coast	Gulf Coast	E. of Mississippi	Colorado
Products Market	East Coast	East Coast	Local	California
Processing by	Conventional Refining to Max. Gaso.	Fluid Hydrocarbon Synthesis	Fluid Gasification + Hydrocarbon Synthesis	Fluid Retorting Hydrogenation Conv'l Refining to Max. Gaso.
% Gasoline in Total Oil Product	87	81	88	90
Investment, per B/D Gasoline				
Plant (incl. raw mat. % trsp.)	$7300	$8800	$10,900	$9500
Possible Housing	.....	.....	3,300	1600
Raw Material Market Price	$2.78/B	10c/MCF	.....	.....
Cost	.....	.....	$4.50/T	$1.15/T
Gasoline Cost, per gal., incl. 15% capital charges				
Raw Material	8.5c	2.5c	5.5c	5.5c
Mfg. & Transp'n less credits	6.0	10.0	16.0	14.0
Total at Marketing Center	14.5	12.5	21.5	19.5
10% Return on investment adds	2.2*	4.7*	7.1c	6.2c
For 10% return on housing invest.	.....	.....	2.1c	1.0c

* Return is on manufacturing and transportation investment only

E. V. Murphree and E. J. Gohr, Standard Oil Development Co. A. I. Ch. E., May 8-12, 1949, Tulsa, Oklahoma.

Exothermic Reaction Techniques

By MARSHALL SITTIG, Chemical Engineer, Detroit

Exothermic reaction techniques are classified and their application for heat removal and control purposes in commercial chemical processes reviewed. The use of fluidized solids reactors in the Fischer-Tropsch process has served to greatly reduce the total volume of cooling surface required. Since a rocket motor is essentially an exothermic reactor, the application of the same principle in chemical process reactor design is considered a possibility. The injection of various fluids as temperature control media in exothermic gas reactions has been patented.

As the frontiers of industrial chemistry are extended, it becomes necessary to enter further into those difficult realms which were formerly considered too hazardous to explore. One of these fields is that of highly exothermic reactions.

In general, many applications of the following unit processes involve the removal of large quantities of heat, sometimes at high temperature levels, halogenation, oxidation, hydrogenation, polymerization.

In addition, nuclear fission might be added to the list. Development work on power-producing piles has uncovered problems in heat-transfer fluids and in structural load-carrying materials[1] which justifiably fall under the heading of exothermic reaction techniques.

In order to achieve close temperature control of exothermic reactions for optimum yields, and in some cases to prevent runaway temperatures with consequent explosion hazards, special reactors and reaction techniques have been developed. It will be the purpose of this article to discuss some of these developments. The general classifications into which these exothermic reaction techniques fall are as follows:

1—Use of fused salt baths as reaction media

2—Use of fluidized solids reactors

3—Application of rocket motor techniques, such as "sweat cooling"

4—Use of "Film reactors" and other miscellaneous types

5—Use of diluents, anti-detonants, etc.

Fused Salt Baths

As outlined by Johnson and Swann,[4] the use of molten salts as combined catalytic and heat-transfer agents has several advantages. Among these are:

1—Molten salts have high specific heats, affording excellent temperature control. As Johnson and Swann point out, the average value of the specific heats of their molten salts may be taken as 0.3 gm. cal./gm./°C., which at a salt density of 2 gm./cc. results in a condition wherein the heat capacity of one cc. of salt is equal to that of 3000 cc. of the gaseous reactant, acetylene, at 600° C.

2—Tar or carbonaceous deposits do not contaminate the catalyst mass, but rise to the surface in a static bath or are removed by flowing salts when the catalyst is circulated.

3—Catalyst preparation is not an art where precise physical structure plays an important part. Catalyst compositions are, in general, easily reproducible.

Low-melting mixtures of various inorganic chlorides have been employed in salt-bath chlorination reactions as combined catalysts and heat-transfer agents.

Vinylidene chloride, as a monomeric raw material for Saran plastics, may be prepared by bubbling ethylene dichloride and chlorine together into a bath of fused salts, according to a patent issued by Reilly.[5] A typical bath composition for this process consists of 60 parts of $AlCl_3$, 30 parts of NaCl and 10 parts of $FeCl_3$, which gives a eutectic melting at 150° C. and boiling above 1000° C. In the above reaction, chloro-olefins are the desired products produced by the combined chlorinating and dehydrochlorinating action of the salt bath catalyst.

Grebe, Reilly, and Miley[6] have patented a process for the preparation of perchloro- (completely chlorinated) hydrocarbons by the salt bath technique.

A further series of patents granted to Reilly and assigned to the Dow Chemical Co. cover the preparation of 1,1,2-trichloroethane[7] by the chlorination of ethylene dichloride at lower temperatures than those employed for vinylidene chloride manufacture (as described above), the chlorination of ethane[8], of benzene,[9] and of acetylene.[10]

The chlorination of acetylene, which is doubly hazardous due to the high heat of the chlorination reaction and the explosive nature of acetylene, is accomplished according to Reilly's patent[10] by mixing acetylene with a non-flammable chlorinated hydrocarbon such as CCl_4, and passing the mixture through a molten salt bath to produce tetrachloroethylene.

Recent work by Gorin, Fontana, and Kidder[11] concerns the chlorination of methane by the use of salt baths made up from the ternary mixture: potassium chloride—cuprous chloride—cupric chloride. In this case, the cupric chloride is the active chlorinating agent, chlorine gas not being used. A mixture of hydrogen chloride and air is used to regenerate the chlorinating agent. Both falling-film and bubbler-type fused salt reactors were employed. Results were compared with those obtained in a fluidized solids bed, employing an alumina gel catalyst impregnated with a potassium chloride-copper chloride melt.

An example of a polymerization reaction using molten salts, as compared to the chlorination reactions discussed up to this point, is the polymerization of acetylene to benzene, which was studied by Johnson and Swann[4] as a wartime source of benzene. Wetted wall columns were employed and halide salt mixtures containing zinc chloride were found to catalyze the reaction as well as serving as satisfactory temperature control media.

Recently, Hanmer and Swann[12] have reported on further work in acetylene utilization by a molten salt process. Acetylene was condensed with ammonia in the hope of making various pyridines. Instead, acetonitrile was produced over halide salt catalysts.

In the above summary on the use of fused salts, we have confined ourselves to those processes wherein the salts are contacted directly by the process gases. The Houdry catalytic cracking process has of course long controlled the exothermic catalyst regeneration step by the indirect use of molten salts in finned heat-exchange tubes within the catalyst bed.

Fluidized Solids Reactors

Although much has been written on the subject of the fluidized solids process for petroleum cracking, it would seem well to review its general potentialities as a heat control technique[13] in exothermic reactions.

As mentioned above, Gorin, Fontana, and Kidder[11] have compared fluidized solids and salt-bath tech-

niques for methane chlorination.

The first application of the fluidized solids process to commercial chemical manufacture was in the highly exothermic oxidation of naphthalene to phthalic anhydride by the Sherwin-Williams Co.[14] This reaction has been a classic example, in texts on organic technology, of one requiring the removal of large amounts of heat at relatively high temperature levels. Boiling mercury has been the usual control medium, surrounding many small catalyst tubes. Recently, however, the fluid catalyst technique has been the recipient of much study[15] as a means of controlling the phthalic anhydride reaction effectively.

With current interest in synthetic liquid fuels, the attention of both Government agencies and private industry has focused on the German Fischer-Tropsch process and its improvement. This process, an application of the unit process of hydrogenation (of carbon monoxide) involves an evolution of 1,800,000 Btu's/bbl. of liquid products produced. German designs employed thin (one-quarter inch) fixed-bed catalyst layers between cooling surfaces and a 10,000 bbl./day plant would have required 128 reactors having a cooling surface of 5,800,000 sq. ft. to dissipate the heat evolved. By the use of catalyst in fluidized beds,[16] it is possible to produce 10,000 bbls./day of product in 4 reactors having 250,000 sq. ft. of total cooling surface.

The iron catalyst itself may be the heat transfer agent in the fluidized solids application to hydrocrabon synthesis from carbon monoxide and hydrogen, either by using cooling tubes in the catalyst bed, or by circulating a portion of the catalyst through an external cooler. Alternately, a second solid material, inert in nature and of larger particle size than the catalyst, may be used.[17] Such a material would be preferentially withdrawn from the catalyst bed, cooled, and returned to the reactor. Firebrick, iron shot, aluminum pellets, sand, metal oxides, or coke in sizes from 10 to 40-mesh may be employed as the auxiliary solids in such a process.

Rocket Motor Techniques

A rocket motor is essentially an exothermic reactor wherein the thrust is the desired product, the chemical reaction products being valueless in their own right. Since the heat transfer problem is so tremendous, however, it would seem that specific experiments in rocket motor design might be applicable to chemical process reactor design, now or in the near future. Evidence that chemical engineers are beginning to regard this field with interest is shown in the program of the Los Angeles Regional Meeting of the American Institute of Chemical Engineers, March 7, 1949. A contribution by R. B. Canright of the Jet Propulsion Laboratory at California Institute of Technology was featured on that program and presented a broad introduction to problems of combustion in liquid-propellant rocket motors.

The heat release per unit volume of rocket combustion chamber is 100 to 150 times that encountered in modern furnaces for high-temperature, high-pressure steam generation. Further, depending on the choice of propellants, this heat is generated at 4500 to 5500° F.[18] The density of heat flow in the motor chamber proper of a typical rocket motor is 1.0 Btu./(sq. in.)(sec.) and values three times as high may be obtained in the nozzle throat.[19]

The heat transferred to the walls of the motor may be handled in one of several ways:[18,19]

1—By heavy uncooled construction to absorb the heat during the brief operating period

2—By refractory lining to protect the walls

3—By regenerative cooling, wherein one propellant is circulated around the chamber to cool the walls before its introduction into the chamber

4—By film coling, wherein one propellant (or an inert material) is introduced so as to bathe the motor walls and evaporate therefrom, cooling by evaporation.

Materials for the first type are chosen[18] on the basis of high values of the product: (specific heat) (thermal conductivity) (density) and copper is commonly used, along with high fuel-to-oxidizer ratios for cool operation.

New refractory materials are constantly being developed[20] for combustion chamber liners in rocket motors. Silica-free mixtures of alumina, beryllia, zirconia, and thoria have been developed at the Bureau of Standards and maintain high strength values up to 1800° F.

Regenerative cooling has been employed in many recent experimental rocket designs in this country. Aniline was the coolant used in one motor[19] combining aniline and red fuming nitric acid as propellants. In this case, the following operating conditions were obtained:

Combustion gas temperature	4500° F.
Gas film temperature at wall	1000° F.
Liquid film temperature at wall	500° F.
Liquid temperature	300° F.

(Aniline boils at 650° F. at 500 lb./sq. in.)

Film cooling was introduced by the Germans in the V-2 rocket. It utilizes the advantages of direct heat transfer and utilization of latent rather than sensible heat as in most regenerative cooling installations. The V-2 motor utilized a great number of small holes through which 75% ethyl alcohol was admitted to the chamber for reaction with liquid oxygen. An extension of the film cooling technique would involve the use of porous walls, whence the coolant oozes in uniformly at all points. This is known as "sweat cooling".

Another interesting exothermic reaction technique employed in the V-2 rocket was the direct generation of steam at 350 psi. pressure and 420° C., by the decomposition of hydrogen peroxide using calcium permanganate as a catalyst. This steam was fed directly to a turbine driving the main fuel pumps in the rocket.

A new ramjet test stand has recently been built by the Chemical Plants Division of the Blaw-Knox Co., again emphasizing the increasing interdependence of chemical engineering and aeronautical engineering. This installation[21] in the Applied Physics Laboratory of Johns Hopkins University employs a packed tower to quench the exit gases from the ramjet motor.

Miscellaneous Types of Reactors

The passage of reactants in narrow channels between closely spaced surfaces is a device often employed in chlorinations to prevent ignition and carbon formation.[22] Distances between surfaces may vary, in typical examples, from 1/32 to ¼ in.

In the vapor-phase fluorination of ethane with elemental fluorine, a quiet, continuous reaction may be carried out by allowing fluorine and ethane to mingle within the meshes of a copper gauze coil, according to Calfee and Bigelow.[23]

A type of reactor in which very efficient cooling is obtained is the so-called "film reactor". Such a reactor, applied to the nitration of benzene, would be operated so that benzene would flow down the inner surface of the reaction tube in a thin film, the nitrating acid being sprayed onto the film from the center of the tube, while a temperature-regulating liquid bathes the outer surface of the tube.[24,25] Such a film reactor has also been applied to the production of alpha-chloro ethers from acetaldehyde and hydrogen chloride.[26]

An extremely exothermic and potentially violent reaction may be controlled by the use of very high gas velocity. For example, oxygen may be removed from the air by reaction with hydrogen when an air-hydrogen mixture in a ratio of 5:14 is passed through a silica tube at 1200° at a space velocity of 10^6 min.$^{-1}$. The exit gas is stated to be suitable for ammonia synthesis.[27]

Use of Diluents, Anti-Detonants

The Standard Oil Development Co. has been issued patents[28] on a method wherein gases are passed into a reactor counter-current to a solid catalyst suspended in a liquid medi-

um, that liquid medium being present in sufficient amounts to absorb the heat of reaction.

The injection of various fluids as temperature control media in exothermic gas reactions has been patented in various instances. The Phillips Petroleum Co.'s Cycloversion catalytic cracking process employs steam injection between catalyst beds as a means of controlling the exothermic carbon-burning reaction in catalyst regeneration. A German patent[29] covers liquid ammonia injection in ammonia synthesis from nitrogen and hydrogen, as well as water injection for the control of other exothermic reactions. Prevention of product decomposition by liquid injection in ammonia oxidation is also claimed.

Inert, volatile substances may be used to prevent overheating in exothermic reactions. For example, sulfur dioxide may be used in the manufacture of cellulose esters.[30]

Of course, the outstanding example of the use of a diluent to assist in the control of an exothermic reaction is the use of water in the emulsion polymerization procers for the manufacture of synthetic rubbers and plastics.

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Non-Soap Lubricating Greases

The Recent Development of Products Using Solids As Thickeners Provides Additional Cause for Changing Trade's Accepted Definition of Lubricating Greases

By RALPH R. MATTHEWS

THE increasing use of finely-dispersed solids, such as a reaction product of bentonite, specially prepared silica powder and possibly others, in multi-purpose lubricating greases—which may in fact revolutionize the manufacture of lubricating greases—emphasizes the need for changing industry's present generally accepted definition of these products.

Under the standard definitions of terms relating to petroleum of the American Society for Testing Materials, D 288-49, first adopted in 1939 and revised as late as 1949, appears the following definition of petroleum lubricating grease:

"A semisolid or solid combination of a petroleum product and a soap or mixture of soaps, with or without fillers, suitable for certain types of lubrication." This is also approved by the American Standards Assn. under Z 11.28-1949, indicating its general acceptance throughout industry.

Even when first adopted, this definition of petroleum lubricating greases did not take into consideration certain petroleum residual products and densified mineral oils. These products contained no soap but they were always considered by the trade as lubricating greases. Recent developments introduce other products which will not comply with the ASTM definition.

In fact, until recent years, gear lubricant was considered a lubricating grease even after it was changed from a sodium, or sodium-calcium lubricating grease, to a straight mineral oil. Of course, formerly it was necessary to thicken the gear oil to prevent leakage from housings of transmission and differential gears. Thus, it was sold to customers by the pound. That is still done, even though most stations offering such service now sell a multi-purpose gear lubricant which is a straight oil blended with required additives.

The purpose of this paper is to call attention to the misnomer of our present standard definition of a lubricating grease, starting with early products of this type. It will be further pointed out that the present tendency toward manufacturing lubricating greases without soaps may have a profound effect on the general nature of such products in the future.

Even as matters now stand, it is quite apparent that Committee D-2 should give attention at once to the matter of revising its definition. It may not be advisable to classify the new products as "Lubricating greases," but rather to set up a new name and definition, such as "Densified Oils," "Non-Soap Lubricating Greases," or something like that. Some of these lubricating greases containing no soap are listed below and will be discussed in the balance of this article:

1—Petroleum Residuums

2—Lubricating Oil, Densified with Asbestos Floats

3—Petrolatum

TABLE 1—Grades of "Crater Compound" and Their Viscosities

Grade	Viscosity*
00	200-210
0	45
1	105
2	200
3	300
5	525

* Saybolt-Furol at 210° F., except Grade 00, which is Saybolt-Universal at 210° F.

Meet the Author

Ralph R. Matthews retired Dec. 31, 1949, as executive vice president of Battenfeld Grease & Oil Corp., Kansas City. A graduate of the University of California, he became a junior chemist in the Petroleum Division of the U. S. Bureau of Mines when its personnel was a director and two chemists. He joined Shell Oil Co. serving in various capacities in its refining department, later becoming head of the lubrication department of Shell Oil Co. He left in 1928 to become vice president in charge of sales for Battenfeld.

4—Polymerized Oil
5—Oil, Densified with Carbon Black
6—Oil, Densified with Finely Divided or Specially Prepared Silica
7—Oil, Densified with Bentones

Petroleum Residuums

It is believed that petroleum residuums were the first of these non-soap, grease-like products marketed. The particular residuum so utilized is generally the end-distillation product of an asphalt-, or naphthene-base crude oil. It has been sold for many years for lubrication of outside gears, chains, and wire rope, including, of course, drag lines, etc. Names such as "Outside Gear Lubricant," "Gear Shield Lubricant," "Wire Rope Lubricant" and others have been used.

This product is a mixture of asphaltenes and asphaltic resins, which gives it a high degree of adhesion. It clings tenaciously to bearing surfaces and keeps wear to a minimum. It should not be applied liberally because any excess will be thrown out and make messy-looking premises and machinery. Grades are indicated in Table 1. It is necessary to heat heavy grades for application, especially in cold weather.

Starting with a heavy grade, this lubricant may be compounded to lighter grades. Some manufacturers have added a little pine tar in preparing it. That apparently increases somewhat the resistance to water.

In the early days of this product, The Texas Co. set up a classification for various grades, taking the viscosities, as determined on the Saybolt-Furol Viscosimeter, except on one light grade for which the straight Saybolt-Universal Viscosimeter was used. That was a great convenience for those using such a product and was adopted as a guide by many other companies. This product was called "Crater Compound," the grades and their viscosities being shown in Table 1.[1]

Grade No. 00 is recommended for enclosed gears under average operating conditions, and also for certain types of chain and exposed gears or wire rope lubrication in cold weather. Other grades are for open or exposed gears, etc. Since Saybolt-Universal viscosities are approximately 10 times the Saybolt-Furol viscosities, and above grades have been sold by some companies as Nos. 500, 1,000, 2,000, 3,000 and 5,000, or Extra Light, Light, Medium, Heavy and Extra Heavy.

As mentioned above, correct application of this product is a little difficult due to the tackiness, particularly in cold weather. This has led some manufacturers to prepare the lubricant so the various grades contain a non-flammable solvent. After application, the solvent slowly evaporates and the lubricant remains on the gear teeth and other points of application. This has, also, helped some in curing the often-occurring fault of "over-lubrication."

Lubes Densified with Asbestos

Probably one of the first instances of a filler being used to densify lubricating oil and produce a grease-type lubricant was after crawler-type tractors were introduced. These tractors were used in all kinds of weather which meant that the truck often traveled in dust, dirt, mud, and water.

Revision Proposed

In the accompanying paper reference is made to the need for revision of the present ASTM definition of lubricating grease. T. G. Roehner, chairman of the Technical Committee of the National Lubricating Grease Institute, has already taken such action and has sent several suggested revisions to the committee members, together with a request for other suggestions.

These will be considered by the Technical Committee at the annual NLGI meeting in Chicago, Oct. 30-Nov. 1. When the committee has agreed on a satisfactory definition for present lubricating greases, the matter will be referred to ASTM Committee D-2 for their consideration and action.—R.M.

Operators and service departments of dealers in crawler-type tractors quickly learned that bearings of rollers and idlers needed a lubricant which would "stay put," and, further, which would repel dirt, mud, and water.

Up to that time, such lubricating greases had been manufactured by using some type of soap for densifying lubricating oil. None of them—not even those using calcium soap—had been found to successfully resist removal by water from the track bearings when the crawler-type tractors were operated under wet conditions.

The lubricant made by densifying oil with asbestos floats is naturally heat-resistant, and will not run out of the bearings when overheated by excessive friction, severe operations, etc. In grading asbestos floats are defined as what is carried suspended under certain volumes and pressures of air. Grades necessary for various seasons of the year were made by varying the quantities of the special densifying medium, and, also, changing the oil viscosity for real cold weather use.

Operators of crawler-type tractors welcomed a lubricant which would extend the life of the tracks from a matter of a few months to several years—the new lubricant really made that type of track practical. Up until this lubricant was introduced, the cost of frequent track replacements had been most disappointing to purchasers. Since those early days, millions of pounds of this special lubricant have been manufactured and used.

Petrolatum

Petrolatum, in most cases, is a by-product recovered in the production of bright stock. Recovery used to be by cold settling, later by centrifuging and then solvent processing. For lubrication purposes, it is generally used as produced with possible variations of melting point and hardness. For special lubrication purposes and medical use, its color and purity may be improved by treatment or filtration or, in some cases, both. Many years ago, the Standard Oil Co. copyrighted the name "Vaseline" for a product of this type.

Petrolatum has been found to be an excellent lubricant for twister rings in knitting mills. It has also proven very satisfactory for lubricating valves and pumps in acid plants, particularly those making nitric acid.

Polymerized Oil

It was fortunate that, before World War II, the Standard Oil Co. (N. J.) sent representatives to Germany to investigate production of rubber-like products from petroleum hydrocarbons. After much research and building of a pilot plant, polymerized butylenes were eventually offered to the trade. The one which was immediately used by the lubricant manufacturers was given the name "Paratac."[2]

Previous to that, manufacturers of lubricating greases had increased tackiness of certain products by the addition of a rubber latex dissolved in light lubricating oil. However, the tackiness which was produced lacked permanency, due to the rubber continuing to slowly dissolve in the oil in the lubricating grease. Since the Paratac additive consisted of hydrocarbons derived from petroleum, there was no such action in greases in which it was used.

For some applications, Paratac has been blended with a straight mineral oil, and the resulting product has a very high degree of tackiness. It would thus cling tenaciously to bearings and also has a high resistance to water.

Oil Densified with Carbon Black

For certain special applications, lubricating oils have been densified to a grease-like consistency with carbon black. Such a product has been found a valuable lubricant at certain points in steel mills.

Oil Densified with Silica

All of those who have done chemical laboratory work will recall that in the old days a real good glass stopcock lubricant was not available. Petrolatum, Vaseline, and other products, made by adding rubber to oleaginous materials, were used; but,

with some materials, especially liquids, the stopcock seal would not hold. In recent years a product was made available by the Dow-Corning Co. which has a silicone diester densified to the proper consistency with finely-divided silica. It is the most satisfactory glass stopcock lubricant which has thus far been made available.

Earlier work which had been done in Germany in densifying oils and the success of the glass stopcock lubricant have caused further investigation of using a special finely-divided silica for densifying lubricating oil to grease-like lubricants. Some chemical manufacturers are offering a silica which is suitable for this purpose.

Naturally, when one thinks of silica, the idea of abrasiveness also enters the mind. C. W. Georgi presented a paper at the 1948 annual meeting of the National Lubricating Grease Institute, entitled "Effect of Inorganic Fillers in Greases on Wear of Anti-Friction Bearings."(3) With a special bearing wear test apparatus he designed, tests were made on silica of several grades combined with an SAE 30 oil.

With 10% of silica powder (3 to 5 microns, or a finer size), a "normal" result was reported. This meant a bearing weight loss of only .01 grams or less. That appears to give silica a clean bill of serviceability, especially so since Georgi points out that part of the loss was, no doubt, due to "fuzz" (as he terms it) on the new bearings. His conclusion regarding the series of tests shown in his paper and covering numerous fillers says in part; "Anti-frictional bearings appear to be considerably more resistant or tolerant to solid particles than is commonly realized. Bearings can apparently tolerate without damage particles of relatively large size, provided they are soft in character; or, particles of very hard nature provided they are of sufficiently small size."

Oil Densified with Bentones

At the 1949 annual meeting of the National Lubricating Grease Institute, a paper entitled "Bentone Greases,"(4) was presented, the introduction of which stated:

"Bentones are the reaction products of bentonite, or, more accurately, montmorillonite, and various organic cations. Montmorillonite is a hydrous magnesium aluminum silicate, with a micaceous structure and an exceptionally *small ultimate particle size*. It occurs customarily as the salt of the moderately strong acid. The montmorillonite used for the production of the Bentones is the Wyoming type in which the cation is predominantely sodium.

"To prepare a Bentone, the montmorillonite is hydrated in a very dilute dispersion to separate the unit particles, and is purified by super-centrifugation to achieve complete removal of non-clay properties. This step is resorted to since most montmorillonites in the crude state contain relatively large quantities of quartz which, if allowed to remain, would impart an abrasive character to the resulting product. The reactive sodium atoms of the unit plates are then replaced by organic cations and the product washed, filtered, dried, etc. to give the final Bentone. A suitable cation is ammonium.

"The preparation of the Bentone greases is, theoretically, a relatively simple operation, accomplished by premixing a slurry of the petroleum oil and Bentone, followed by a milling operation. The machine used was a three-inch Premier Colloid Mill."

Various properties were tested in the laboratory and stability to working was found to be as good or better than most soap base lubricating greases. Resistance to heat is good, but there is no definite melting point (dropping point). Its consistency will not change appreciably until the heat drives the organic radical off the Bentonite.

No corrosion of brass or copper was noted, and oxidation resistance was satisfactory. The latter properties would, of course, be governed by the oil in the grease. Due to the fineness of the Bentone, wear characteristics were satisfactory. Wheel bearing tests on the government wheel bearing tester and other test machines were well within the required limits. Water resistance appeared satisfactory, but the water absorption test showed considerable quantities of water were absorbed. Thus, under continued wet-operation conditions, the grease might be washed from a bearing. In that connection, slides tested under the usual salt-spray procedure were found to have poor resistance to rusting. However, in the last annual report of the Mellon Institute, it was indicated this property had been improved.(6)

A later paper on Bentone greases, was given in St. Louis, June 16, 1950, at a Colloid Symposium of the American Chemical Society by the same authors who presented the paper before the Lubricating Grease Institute.(5) It was brought out that Bentone No. 304 is the only bentonite product now offered for the manufacture of lubricating greases. It contains two methyl groups and two long chain, fatty acid groups.

The size of the particles before dispersion is about 4 microns, but after dispersion 1.5 microns. When fully dispersed to the latter approximate size, the oil in the lubricant is on the outside of the particle. Thus, the Bentone does not enter into the lubrication picture until the oil has been removed from the particles by bearing action, or otherwise.

There is no phase change with Bentone greases. A temperature-penetration curve comparing with Lithium (20% soap), Barium (23% soap), Sodium (16.5% soap), and Calcium (11% soap) showed the smallest change for Bentone.

The product was shown to have excellent stability, a low torque at low temperatures, good adhesion to metal, and water resistance, according to the test method used.

At present prices for Bentone of National Lead Co., St. Louis, a price of about 11c/lb. bulk for Bentone grease is indicted, but several manufacturers have sold Lithium greases considerably below that figure. However, as the selling price becomes more competitive and as Bentone lubricants continue to show their superiority, they should find ready markets. This has been proven by the fact that large volumes of Barium and Lithium lubricating greases have been sold at prices considerably above the so-called regular types (Calcium, Sodium, Aluminum, etc.)

At the fifth annual meeting of the American Society of Lubrication Engineers, in Detroit April 10-12, the Warren Refining and Chemical Co. of Cleveland, displayed "Plastilube —The Successor to Grease." This is a Bentone product, and samples given out were of an attractive, reddish-yellow, translucent color. A pamphlet issued by the company refers to "Plastilube" as an "all-purpose lubricant." The following are among the properties claimed for it; water resistant, non-bleeding, never melts, no phase change, better adhesion, better pumpability.

In view of the experience to date with lubricating greases in which bentone, silica and other forms of finely-dispersed solids are used in place of metallic soaps, and the conclusions in the paper by Georgi,(3) it would appear that the manufacturers of greases have been unduly alarmed about the abrasive effect of solids in lubricating greases. Also it seems clear that the standard definition of petroleum lubricating greases should be revised to recognize products of this type.

Acknowledgment

Thanks are due the following for assistance in preparing this paper: C. J. Boner, chief research chemist, and G. A. Williams, chief control chemist, Battenfeld Grease & Oil Corp., Kansas City.

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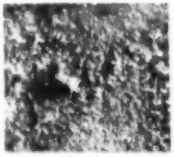
ACID HANDLING AND HEAT REMOVAL ARE KEY PROBLEMS IN DESIGN



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Plant Practices

Practical Tips and Ideas for Improving Operations

Field Application of Alloy Strip Liners Inside Refinery Vessels by Welding

From a Report by Cities Service Oil Co., East Chicago, Indiana

Though not intended as a guide to correct procedures, this account of one refiner's experiences in welding alloy liners will be of help to those planning to get into this type of work. Principal lining material used was Types 405 and 410 stainless steels, 5/64 in. thick, with electrodes of 25-20 Cr-Ni alloy. Good results were obtained with 2-bead welding on a vertical strip installation. Considerable attention is given to the preparation of the surface on which liners are to be installed.

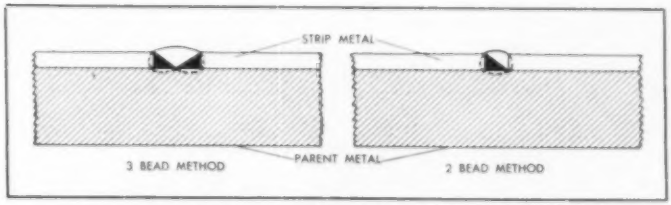


FIG. 1—Details of 2-bead and 3-bead welds for alloy strip liners

MOST alloys that may be used in refinery vessel linings are easily welded when proper conditions and procedures are developed; and when welders are experienced or properly trained in this type of work.

In the preparation of the vessel walls all irregularities caused by corrosion such as pitting and so on should be removed by grinding or chipping as conditions require, and the surface must be cleaned thoroughly by sand or shot blasting or other methods that will remove all oil and coke deposits from the small pores and pits in the surface. Our experience has been that, even though the surface is cleaned by sand blasting, it becomes much more weldable and a better job will be obtained if the small sharp points caused by pitting are removed with a surface grinder before applying the lining. This does not mean that we always grind out all the pits, as it is many times impractical to do this.

In many older vessels the tray support rings or angles are welded on one side only and coke is built up in back of the ring. These rings must be removed, if it is necessary to protect the shell back of the rings, since it is difficult to seal weld over the coke or oil that is behind the rings.

Selection of Electrode

An electrode with similar analysis to the alloy liner to be installed should be used. When using stainless steel liners, an electrode with higher alloy is used to avoid dilution due to the pickup of iron from the steel shell.

Most of our experience has been with the 5/64 in. thick, Type 405 and 410 stainless (11-13% chrome) steel. For welding this alloy we use 25-20 stainless electrode. We have spent much time in determining the size electrode and current settings for welding this material. The following data was used to help determine the size rod to be used:

We selected some 1½-in., low carbon plates, placed them in a vertical position and welded 5/64 in. thick, Type 405 stainless pieces to the plates. One each was welded with ⅛-in., 3/32-in., and 5/64-in. diameter 25-20 electrode. Care was taken to secure the right settings on the machine, to simulate the weld that would be obtained in the field. The weld was then ground and polished and the hardness taken at several points across the fusion zone. Hardness impressions were started in the weld and proceeded across the fusion zone into the plate, with the results in Brinell hardness numbers as shown in Table 1.

After obtaining the above results it was our belief that the size rod used had little effect on the hardness obtained in or adjacent to the weld, except that it appeared that the heat-effected zone caused by the larger rod was wider than that of the smaller rod. We probably had the same hardness in all cases, but the hard zone was so narrow that it was difficult to locate and test even with the small point of the Vickers Brinell machine.

Based on the above results our decision was to use ⅛-in. electrode for welding and 3/32-in. for tacking sheets into place. We have since discontinued using the 3/32-in. rod almost entirely, due to the higher waste in using the smaller diameter rod, together with the necessity for changing the current settings on the welding machines when using two sizes of rod. We found that the 5/64-in. diameter rod was impractical to use in our lining work. We have also found that ⅛-in. diameter electrode is best for welding 5/64-in. thick Monel liners in all positions.

Method of Attaching Liners

Our method of attaching the strip has changed somewhat since our first experience, which was lining coke stills, 10-ft. diameter by 40 ft. high, with 5/64-in. thick, Type 405 stainless strips, 3 ins. wide by 30 ins. long. In these we applied the lining to the shell by running the strips around

TABLE 1—Brinell Hardness of Stainless Steel Welds

(25-20) 1/8-in.	(25-20 rod) 1/8-in.	(25-20 rod) 3/32-in.	(25-20) 5/64-in.
180.5	178	179-161	169
183.5	178	228-184	201
235	185	156-207	152
173	234	156	...
157	234	...	...
167 Plate	159	...	...

horizontally and welding by the 3-bead method. Spacing between the sheets was about ¼ to ⅜ in. Each sheet was welded around completely, then the slag removed and a center bead run between the two welds.

These thin sheets require no special jacking to make them tight against the wall, but they are tacked every 4 to 6 in. to keep them from warping out when welding. It is essential that they be held tight against the wall and not struck with a hammer immediately after tacking. This practice sometimes causes a crack in the tack which gives trouble when the final weld is made. These small cracks can also cause a leak when the vessel is put in service. As small a tack as possible should be used, to make the welding less difficult.

Our experience in welding strips in the horizontal position was satisfactory, but we found that the horizontal weld was difficult for most welders and also caused more trouble in slag removal and slag trapping. We therefore changed from a horizontal to a vertical strip installation and most of our welding was then downward. However, it was necessary to use slightly higher current when welding downward, but the increase in welding speed seemed to provide less heat input than other methods. Slag removal was much easier and the bead appearance was better, making inspection easier. We had far less leaks or small holes with the vertical strips and the job was speeded up a good deal.

Obtain Good Results

On some of the jobs, experiments were made with 3-bead, 2-bead and even 1-bead welding and it is believed that the method to be selected depends a good deal on the ability and dependability of the welders. We have had good results both in application and in service with the 2-bead method. It gives a good appearance, is far less work and it is believed has proved as serviceable as any other method. It has effected installation savings of as much as 50% over the 3-bead method. Fig. 1 shows the 2-bead and 3-bead method of installing alloy strip lining.

In applying the 2-bead method one sheet must be put on at a time, so that one vertical bead is welded and the next sheet applied as close as possible to the last bead. The final bead fills from one sheet to the other with very little iron pickup. With this method the welder must be known and dependable inasmuch as it would be impossible for an inspector to check the first bead unless he stayed on the job all the time.

After the job or a given area has been completed it is mechanically wire brushed and checked by the welder, and then inspected visually. Some inspections are made by use of an oil penetrant to locate minute flaws or cracks invisible to the eye. The welding has been mostly done with 300 amp. electric motor driven machines, using current from 85 to 100 amp. at the machine.

Lining Dished Heads

Lining dished head domes and vessel bottoms presents an individual problem for each vessel. We have learned that, for most of these, the cutting of pieces can be reduced by quartering the surface. We start installing strip lining on the quadrant centers and progress each way until the quarters meet. Then, by staggering the strips they fit very well with little cutting. It is sometimes necessary to cut a wedge-shaped piece between quarters at the finish. The spacing between sheets will vary somewhat in this section but this condition can be remedied by running one or more extra beads to cover up the shell metal.

On shorter radius domes it may be beneficial to lay out templates on the drafting board and to cut each piece prior to applying, but we have not found this necessary in our work. For lining manways and nozzles, variations of the strip lining technique may be used for the larger openings. On smaller openings, in lower temperatures, we use rolled liners slipped into place and welded at each end. In lining openings in high temperature vessels, an expansion ring of liner material inside the vessel should be installed. This ring welds to the liner on its inside diameter and to the shell on the outer diameter, allowing the liners to expand without buckling.

Welders may be tested by watching them weld test plates. We have made plates of ⅜-in. carbon steel about 8 ins. square and placed upon them 4 pieces, 3 in. square, of 5/64-in. Type 405 or 410 stainless steel. The plates are placed in a vertical position for welding. After welding, we bend them on about a 1½-in. diameter mandrel, the bend being parallel to one of the cross welds. This test reveals porosity and there will also be a crack in the fusion zone if it is too hard or poor penetration.

Good working conditions are important for a good welding job. These should include good scaffolding, good preparation of the surface to be welded, proper care of the electrode to give protection from dampness and good welding equipment.

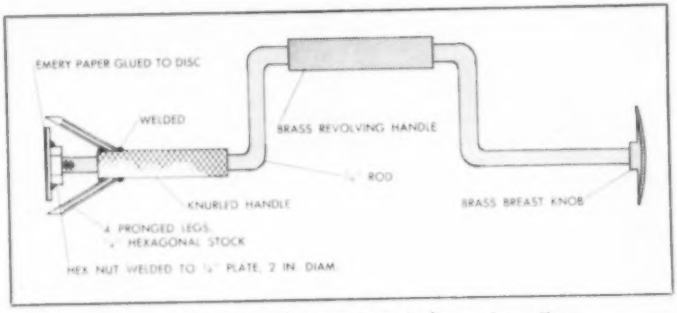


FIG. 2—Cleaning tool for making Audigage inspections

Hand-Operated Tool Cleans Spots On Vessel Walls for Audigage Tests

REFINERY vessel safety inspections using such devices as the "Audigage" require a thoroughly clean spot on the vessel wall. This is necessary to insure proper functioning of the Audigage head. The best location requires a small circle approximately 2 in. in diameter.

The inspection department at the Standard Oil Co. (Ohio) Lima refinery has developed and built in the shop a simple tool for cleaning such locations on vessel walls. Illustrated in the sketch, Fig. 2, it is essentially a brace with a sanding disc substituted for a conventional drilling bit. Emery paper is glued with regular disc cement to the rotating dics.

Low Cost Salvage Wagon Cuts Oil Loss to Wastes

AN INEXPENSIVELY built tank wagon serves successfully a three-fold purpose in oil recovery at the Baton Rouge refinery of Esso Standard Oil Co., La. Division. In the first three months of operation, it was instrumental in salvaging over 2400 bbls. of oil. It is maintained

OVER 5 MILLION POUNDS OF service satisfaction

B&W TUBE SUPPORTS are *cast to last* in petroleum processing services — *and they do.* Installations totalling more than five million pounds of these alloy steel castings have been subjected to operating temperatures up to 2000 F, and corrosive, oxidizing and abrasive conditions ranging from ordinary to severe . . . *and not a single service failure has been reported.* Let B&W cast this outstanding service satisfaction into the next tube supports you need for new equipment or replacements. You'll be glad you did.

CAST TO LAST

Products of B&W Engineering for Economy

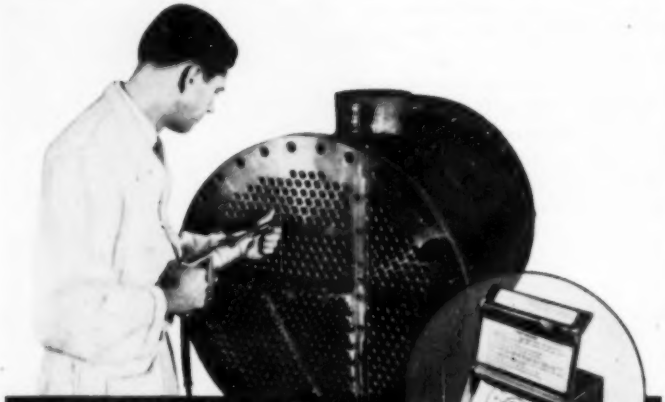
BABCOCK & WILCOX

for the purpose of preventing river pollution, for recovering oil that otherwise would remain in open ditches and low places instead of flowing to sewers and separators, and for removal of light oil from certain locations as a safety measure.

The equipment consists of a 3,000-gal. tank mounted on wheels and drawn by a tractor. The tank wagon is equipped with a GPM Carter plunger sludge pump, driven by a Chrysler industrial gasoline engine, and it carries about 200 ft. of suction hose, skimmers, and strainers. The hose is provided with "Ever-Tite" quick-coupling connections.

The wagon was purchased originally for the transfer of acid sludge. In its conversion at a cost of less than $1500, the wagon was fitted with air brakes and built to specifications that permit its movement over state highways and parish roads.

In two recent instances the wagon has been used to good advantage. In one case, oil which would have eventually reached the parish canal and caused serious pollution was picked up from drainage ditches at a nearby tank farm. In another case, light oil was pumped from an overloaded sewer at the pipe stills to prevent the content from backing up inside the firewall at the furnaces.



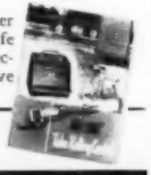
CONTROLLED
TUBE ROLLING
IS MORE EFFICIENT
with the JOHN CRANE Control

Because

- There are only two electrical working parts; no electronic tubes.
- Operators do not need special skills.
- It is easily portable on the job; no voltage regulator is needed.
- Circuit alignment is automatic.
- Maintenance is eliminated.

This precision tube rolling development simplifies controlled expanding of condenser and heat transfer tubes to the point where operating skill is no longer necessary for perfectly rolled tubes.

Original cost of the unit is lower than that of any other controlled tube rolling development, and it has longer life because of its few working parts and the absence of electronic tubes. An investigation of its possibilities can save you money and improve your condenser performance.



This booklet describes the advantages, design and operating steps of the "John Crane" Control. Send for a copy: Dept P-10, 1832 Cuyler Ave., Chicago 13, Ill.

JOHN CRANE
PACKINGS AND MECHANICAL SEALS
CRANE PACKING COMPANY
CHICAGO
Offices in All Principal Cities in United States and Canada

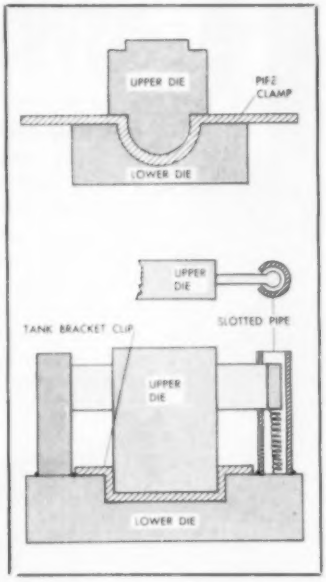


FIG. 3—Die hammer for turning out pipe clamps or tank bracket clips

Steam Hammer Speeds Up Stamping Out Pipe Clamps

THE job of turning out pipe clamps and tank bracket clips now is very fast and simple in the boiler shop of Esso Standard Oil Co. Baltimore refinery. The steam hammer and a stock of properly designed dies turn out the clips and clamps as fast as they are needed.

The two types of dies are illustrated in Fig. 3. Pipe clamps of 2 to 8 in. diameter formerly were made by hand, usually from bar stock in sizes not over ⅜ by 2 in. Now all clamps within this size range are turned out with the steam hammer. Those over 8 in. in diameter are rolled on a mill.

In the case of the tank bracket clips they are almost always the same size, ¼ by 2 in. stock. As can be seen in the sketch a spring arrangement has been employed for the upper die. In operation the hammer comes down hitting the upper die, then backs away. Meanwhile the spring pushes the die up so another piece of stock can be inserted. In this way clips can be turned out virtually on a production line basis.

[*To obtain more data on advertised products see page* 1116]

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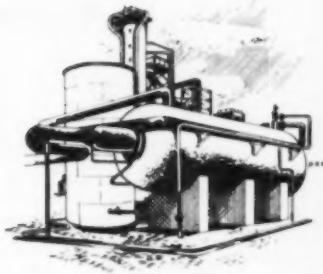
LOW COST



TRET-O-LITE
CHEMICAL DESALTING

Tret-O-lite Chemical Desalting increases refining efficiency by keeping essential equipment on stream. Salt-caused difficulties such as plugged towers and exchangers, corrosion from evolved HCl and the formation of hard, flinty coke in furnaces all result in short runs and high maintenance costs. By eliminating most of these troubles, and reducing others to a minimum, Tret-O-lite Desalting assures more time on-stream, with lower maintenance expense.

The Tretolite Company provides a complete desalting service: ENGINEERING, LABORATORY TESTING and SALT PROBLEM CONSULTATION. For complete information, write or call

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DEHYDRATING | **DESALTING**

TRO 49-3

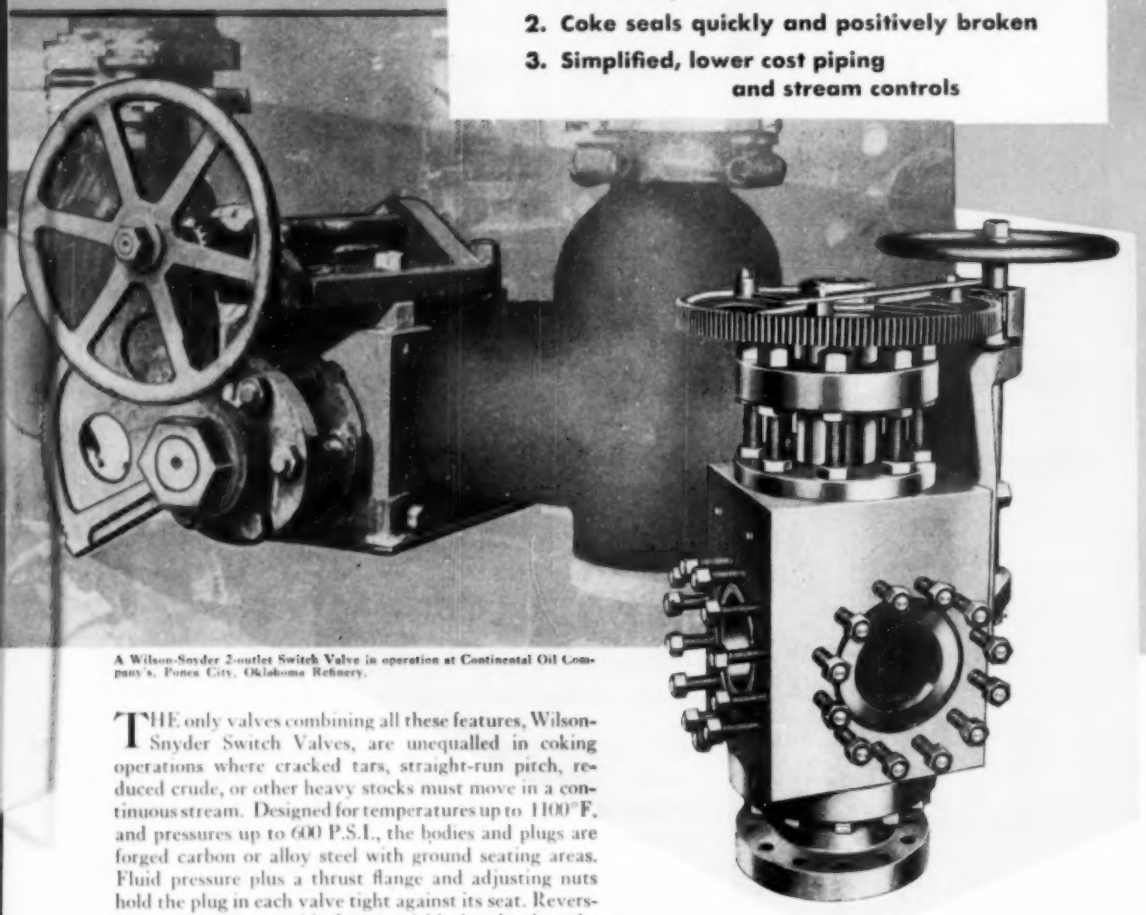
PLANNING ON RUNNING TO COKE?

Then you'll want

WILSON-SNYDER SWITCH VALVES

to insure:

1. Uninterrupted flow when switching
2. Coke seals quickly and positively broken
3. Simplified, lower cost piping and stream controls



A Wilson-Snyder 2-outlet Switch Valve in operation at Continental Oil Company's, Ponca City, Oklahoma Refinery.

THE only valves combining all these features, Wilson-Snyder Switch Valves, are unequalled in coking operations where cracked tars, straight-run pitch, reduced crude, or other heavy stocks must move in a continuous stream. Designed for temperatures up to 1100°F. and pressures up to 600 P.S.I., the bodies and plugs are forged carbon or alloy steel with ground seating areas. Fluid pressure plus a thrust flange and adjusting nuts hold the plug in each valve tight against its seat. Reversing nut pressure on this flange quickly breaks the coke seal.

Wilson-Snyder Switch Valves are available in sizes from 2" to 10" with single inlet and two, three, or four outlets, or the reverse. Connections to suit your requirements can be furnished in any case.

Your local "Oilwell" representative will gladly give you complete information on Wilson-Snyder Switch Valves and pumps for all refinery applications.

Close-up view of a Wilson-Snyder Switch Valve ready for installation.

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USS "OILWELL"

UNITED STATES STEEL

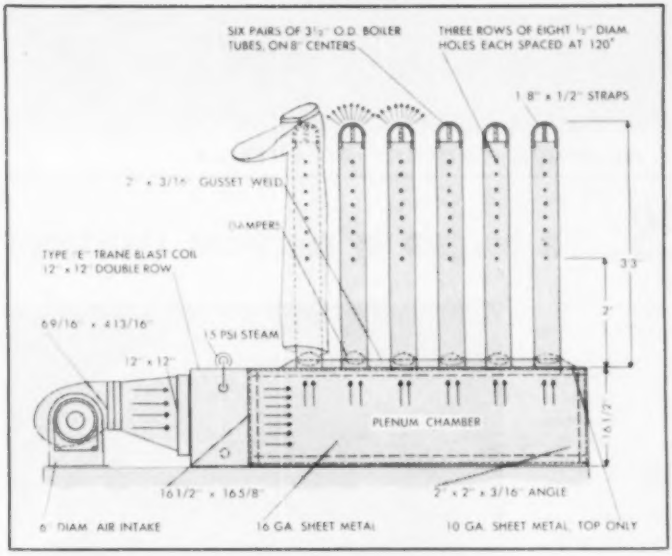
SIX PAIRS OF 3½" O.D. BOILER TUBES, ON 8" CENTERS
THREE ROWS OF EIGHT ½" DIAM. HOLES EACH SPACED AT 120°
1 8" x 1/2" STRAPS
2" x 3/16" GUSSET WELD
DAMPER
TYPE "E" TRANE BLAST COIL 12" x 12" DOUBLE ROW
69/16" x 413/16"
15 PSI STEAM
12" x 12"
33"
2"
16 1/2"
PLENUM CHAMBER
16 1/2" x 16 5/8"
2" x 2" x 3/16" ANGLE
6" DIAM. AIR INTAKE
16 GA. SHEET METAL
10 GA. SHEET METAL, TOP ONLY

FIG. 4—Boot dryer used at Lockport Works, The Texas Co.

Home-Made Drier Reduces Stock Requirements of Employes' Boots

By HARLEN W. FOX, The Texas Co., Lockport, Ill.

A SHOP-BUILT boot dryer installed in the tool room at the Lockport Works of The Texas Co. has effected considerable economy in the stock of boots being carried in stock for employes' use.

Under the present scheme, all boots issued to workmen are turned in to the tool room at the end of each shift. This is done because it is not economical to allow an individual workman on each shift to retain a pair of boots in his possession for use only at intervals. A limited supply of boots can therefore be kept in stock provided they are washed in a disinfectant solution before being re-issued.

In order to provide adequate facilities for drying boots which have been washed in disinfectant, it was necessary to fabricate a dryer as illustrated in Fig. 4. This piece of equipment can dry six pairs of boots per hour. It consists of a blower powered by a ⅛ hp., 110 v. motor, mounted in a suitable position to blow air through a fin pipe steam coil into a plenum chamber and then into twelve, 3-in. diameter, vertical stacks over which the boots are hung to dry.

A temperature regulator is installed at the steam coil inlet with a thermostatic bulb placed in the plenum chamber to control the temperature of the air and prevent overheating, which would deteriorate the boots. The equipment is mounted on a steel frame which forms a compact unit.

Previous practice was to use a small fan and an electric heating element so constructed to blow warm air into the boots being dried. It was only possible to dry one pair of boots per hour, which was inadequate to meet the demand.

IDEAS—Needed!

Plant superintendents, foremen, engineers, chemists, researchers, technicians—Send in your own ideas on "How we do it in our refinery," or "How we do it around our laboratory."

Possible subjects could include special apparatus, gadgets, tools, shortcut methods, time and money savers, accident and fire prevention schemes. The idea is the important thing—we'll dress up your sketches or photographs and write up your data. Material submitted for publication exclusively in PETROLEUM PROCESSING will be paid for at the usual space rates. Send in your ideas and contributions to:

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Southwestern Division: 2512 So. Blvd., Houston 6, Tex.

[*To obtain more data on advertised products see page* 1116]

ALCOA

Alcoa Heat Exchanger News

PUBLISHED BY ALUMINUM COMPANY OF AMERICA

ALCLAD TUBES...a bargain in corrosion resistance

If you are troubled by the corrosion effects of sulfur compounds, oxygen, or carbon dioxide in cooling waters, alclad tubes offer a long-lasting solution.

Alclad tubes have given long service life in many fresh, brackish, and salt waters where high industrial contamination exists. Alclad tubes withstand waters having a wide pH range.

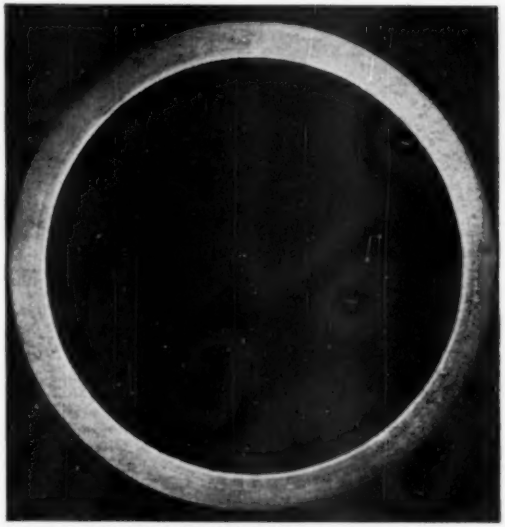
Coating Resists Corrosion

The zinc-aluminum alloy layer galvanically resists corrosion of the base aluminum alloy structure of the tube—acts like a "built-in" anode. Corrosion is confined within the integral cladding layer. Even when large areas of the alclad coating have been destroyed by electrolysis, the rest of the coating still continues to protect the exposed alloy core. Alclad tubes have withstood such corrosive attack for more than ten years, without failure.

Alclad Costs Little

The remarkable thing about alclad tubes are their low price. Foot for foot, metal for metal, they cost less than any other tubes except bare aluminum. Twenty per cent less than ordinary steel. Forty-seven per cent less than Admiralty. A sixth as much as stainless steel.

We'd like to tell you more about the savings possible with alclad tubes—amounting to thousands of dollars every month in many plants. Write to us. ALUMINUM COMPANY OF AMERICA, 1493K Gulf Building, Pittsburgh 19, Pennsylvania.



ALCOA OFFERS NEW BOOK This new, 24-page book will answer many of your questions about Alcoa tubes. It covers fabrication techniques, alloy selection, chemical and petroleum applications. It describes tube cleaning, inhibitors, cathodic protection. It contains complete information on fluid flow and heat transfer. There are formulas, tables, and specification data. Write for your free copy today. ALUMINUM COMPANY OF AMERICA, 1493K Gulf Building, Pittsburgh 19, Pa.

THESE APPLICATIONS ARE NATURALS FOR ALCLAD TUBES:

Petroleum

- Condensing of hydrocarbon fractions such as naphtha, gasoline, and gas oil
- Vapor-recovery condensers
- Lube-oil coolers
- Natural-gas compressor after-coolers
- TCC overhead condensers
- Recompressor aftercoolers
- Hydrogen-sulfide gas coolers
- MEA-solution coolers and exchangers
- Furfural condensers and exchangers
- MEK service
- Propane chilling
- Wax sweaters
- Depropanizer overhead condensers

Chemical

- Butanol
- Ethanol
- Ethylene Glycol
- Glycerin
- Hydroabietyl
- Isopropanol
- Methanol
- Phenol
- Propylene Glycol
- Acetaldehyde
- Formaldehyde
- Acetic Acid
- Butyric Acid
- Stearic, Palmitic, Oleic Acids
- Recinoleic Acid
- Acetanilide
- Ammonia and Ammonium Hydroxide
- Hydrogen Cyanide
- Nitric Acid (concentrated)
- Pyridine
- Hydrogen Sulfide
- Benzene
- Benzol
- Dichlorobenzene
- Gasoline
- Gelatin
- Hydrogen Peroxide
- Methyl Ethyl Ketone
- Turpentine

These listings cannot cover the many hundreds of other chemicals with which aluminum tubes can be used

Patent Trends in Petroleum Refining

By Peter J. Gaylor, Editor "The Technical Survey"

Recovering Mercaptans From Spent Caustic

IN ONE of our early articles[1] on recovery of spent caustic, we mentioned that, to the best of our knowledge, there was no issued patent broadly covering the use of tannic acid as an oxidation catalyst in the air blowing of mercaptan-contaminated caustic soda. Lately, this situation has changed to a significant degree.

On August 1, 1950, U.S. Patent 2,516,837 issued to John Happel and Stephen P. Cauley, and was assigned to Socony-Vacuum Oil Co. Although this patent still does not cover the use broadly, it may cover the best commercial means for utilizing tannic acid as a catalyst for such a purpose. The patent points out that if oxidation of spent caustic containing mercaptans is continued until all of the mercaptans are oxidized, then the oxygen reacts with the tannic acid, destroying its ability to act as a catalyst. Accordingly, the patent specifies oxidation only to the point where at least 0.1% of the mercaptans still remain unoxidized in the caustic, thereby controlling the extent of the oxidation to protect the tannic acid catalyst. Such a practice is believed to be followed in recovery of caustic from the solutizer process, and Rippie[2] states that as much as 2.5 grams per liter of mercaptan sulfur is recycled with the caustic, which factor does limit the extent of removal of mercaptans from the gasoline being caustic-treated. It is interesting to note that the Happel and Cauley patent application was originally filed in 1942 and was abandoned and then refiled in 1943.

A patent issued to Standard Oil Co. (Ind.)[3] discloses limiting of the regeneration to protect the tannin catalyst. The amount of mercaptan to be left unoxidized is specified as 100-400 milligrams per 100 milliliters.

Pure Oil Co. also has obtained some patents on tannic acid as a mercaptan-solubility promoter in conjunction with solutizers, as well as other phenolic organic compounds as substitutes for tannic acid[4].

Inhibiting Emulsification of Polyacrylate-Thickened Lubes

ONE recent patent (U.S. 2,516,914) issued to Tide Water Associated Oil Co. points out that oil-soluble polymerized esters of the acrylic series (such as Acryloid 150) are valuable additives for lubricating oils, improving VI, depressing pour point, etc. However, these polymers do induce emulsification when the lubricating oil is employed in presence of water, steam or moisture.

This emulsification tendency is inhibited by addition of certain amines and acid esters of a phosphorus acid, which combination also acts to inhibit rusting. A suitable inhibitor combination includes 1.15% diamylaminomethyl cardanol and 0.5% lauryl acid orthophosphates (a mixture of mono and di-lauryl acid orthophosphate).

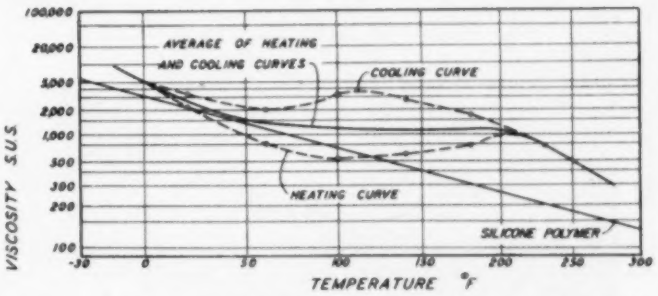


FIG. 1—Comparison of lube oil in California Research Corp. patent U.S. 2,489,281 with silicone oil

High Viscosity Index Lubricating Oils

EVER since the introduction of Silicone oils, petroleum refiners have been attempting to produce additive blends approximating Silicone oils in viscosity-temperature characteristics. In its U. S. patent 2,489,281, California Research Corp. describes some lubricating oil compositions which come close to the Silicones in such performance.

One example given is as follows:

	wt. %
Octyl methacrylate polymer (Acryloid HF)	15
Aluminum trioleate (50% oil solution)	12
2-Tert-butyl-4-methyl phenol	0.2
Cetyl mercaptan	0.2
Mineral oil (California naphthenic)	72.6

Such a composition exhibits the following properties: Gravity, API 32.9°, Flash 210° F., Fire, 225° F., Pour point —70° F., Water 0.05%. It is claimed to be non-corrosive to aluminum, copper, magnesium and steel, can be exposed to rapid changes at high and low temperatures, and can be diluted with further amounts of base oil without polymer precipitation.

The characteristics of this blend, in comparison with Silicone polymer, are illustrated in Fig. 1 which shows the heating and cooling curves for the blend. The solid line between the two dotted lines is the average viscosity curve, over the temperature range indicated, of the heating and cooling curves of the blend.

References

(1) Gaylor, P. PETROLEUM PROCESSING, 3, No. 12, p. 1219, 1948.

(2) Rippie, C. W. "Trends in Treating", *Oil & Gas Journal*, 48, No. 47, p. 110, 1950.

(3) U.S. 2,413,945 (Standard Oil Co.-Ind.), Gaylor, P. PETROLEUM PROCESSING, 2, No. 3, p. 182, 1947.

(4) U.S. 2,453,067 (Pure Oil Co.), Gaylor, P. PETROLEUM PROCESSING, 4, No. 2, p. 179, 1949.

Patents Issued in August

The following classified listing gives the patent number, patentee or assignee, and a brief description of all patents believed to be of direct interest to the petroleum processing industries, as contained in the Official Gazettes of the U. S. Patent Office for August 1, 8, 15, 22 and 29, Vol. 637, Nos. 1-5.

Fuels

2,517,066 (The Texas Co.)—Polymer gasoline.

Conversions

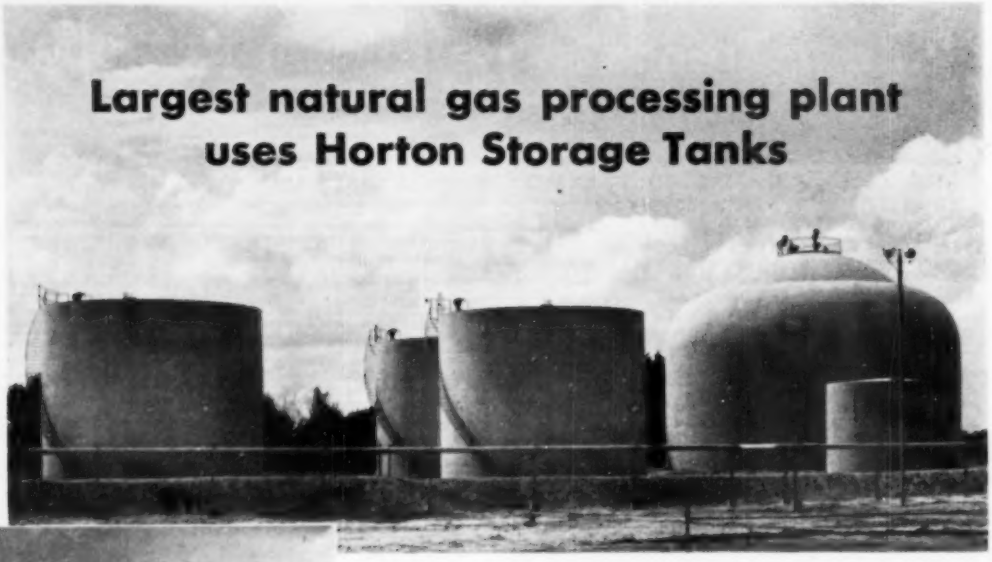
2,516,943 (The Texas Co.)—Catalytic treatment of hydrocarbons in horizontal reactor.

2,517,042 (M. W. Kellogg Co.)—Transferring fluidized solid particles.

2,517,139-141 (Sinclair Refining Co.)—Pyrolytic conversions of hydrocarbons.

2,517,525 (Sun Oil Co.)—Catalytic reaction apparatus having alternate endothermic and

Largest natural gas processing plant uses Horton Storage Tanks



The Carthage Corporation's new natural gasoline plant at Carthage, Texas, is the largest built to date for the delivery of dehydrated natural gas to transmission pipe lines. It has an absorption capacity of 385,000 M.c.f. daily. At this time, products recovered each day average 40,000 gallons of propane; 75,000 gallons of butanes; 5,500 bbls. of motor fuel; 560 bbls. of kerosene; and 150 bbls. of residuum.

The accompanying views show some of the storage tanks which we fabricated and erected at this efficient plant. The 5,000-bbl. cone-roof tanks shown above are used for storing naphtha, kerosene, and mineral seal oil; the 20,000-bbl. Hemispheroid at the right in the general view and at the left stores gasoline at 2½ lbs. per sq. in. working pressure; and the 1,000 bbl. cone-roof tank stores residuum.

Horton flat-bottom storage tanks with cone-roofs are available in standard capacities from 500 to 268,000-bbls. or in special sizes to meet your requirements.

The Hemispheroid is built in capacities up to 30,000 bbls. for 2½ lbs. per sq. in. working pressure and up to 7,500 bbls. for 5 lbs. pressure. Get full details from our nearest office.

Some Facts about the Horton* Hemispheroid

The Horton Hemispheroid is used primarily for the storage of motor fuel, aviation gasoline, and the less volatile grades of natural gasoline. When storing volatile liquids like these under normal operating conditions, the Hemispheroid reduces filling losses and stops practically all breathing losses.

Special Horton* Tank Roofs

In addition to cone-roof or pressure storage tanks we also fabricate and erect tanks with Horton Floating Roofs and Horton Vapordome Roofs. These roofs are used to reduce losses from flat-bottom tanks storing volatile hydrocarbons.

Write our nearest office for complete information and quotation when you need storage tanks of any type. Please state number of tanks required, capacity, location and diameter and height if special dimensions are required.

**Horton is the trade name used for all products built by . . .*

CHICAGO BRIDGE & IRON COMPANY

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Chicago 4	2114 McCormick Building	Los Angeles 17	1526 General Petroleum Building	Seattle 1	1330 Henry Building
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Motherwell Bridge & Engineering Company, Limited, Motherwell, Scotland
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Sociedade Chibridge de Construccoes Ltda., Rio de Janeiro, Brazil

exothermic zones.
2,517,900 (Phillips Petroleum Co.)—Liquid phase catalytic cracking.
2,518,270 (Standard Oil Development Co.)—Fluidized material reactor.
2,518,307 (Phillips Petroleum Co.)—Automatic control of catalyst promoter in hydrocarbon conversion.
2,518,354 (Standard Oil Development Co.)—Maintaining catalyst activity in a dehydrogenation process.
2,518,474 (Phillips Petroleum Co.)—Use of mobile catalyst in cat. cracking.
2,518,546 (Standard Oil Co., Ind.)—Cracking with HF catalyst.
2,518,583 (Universal Oil Products Co.)—Tubular catalytic reactor.
2,518,693 (Standard Oil Development Co.)—Contacting finely divided solids and gases.
2,519,034 (Standard Oil Development Co.)—Low temperature polymerization of mixed olefins with $AlClBr_2$ catalyst.
2,519,072 (Standard Oil Development Co.)—Non-catalytic alkylation under high pressure (over 100,000 psi).
2,519,150 (Gulf Oil Corp.)—Apparatus for stripping fluidized solids.
2,519,315 (Socony-Vacuum Oil Co.)—Apparatus for heating granular solids.
2,520,146 (Houdry Process Corp.)—Catalytic conversion of atomized particles.
2,520,149 (Koppers Co.)—Low boiling olefins by cracking hydrocarbons in presence of carrier gas.
2,520,482 (Socony-Vacuum Oil Co.)—Insulated conduit to reactor.
2,520,717 (Socony-Vacuum Oil Co.)—Contactor for granular solids.

Refining

2,516,837 (Socony-Vacuum Oil Co.)—Regenerating aqueous alkali by oxidation in presence of tannic acid, etc. and unoxidized sulphur compounds.
2,516,876 (Gulf Research & Development Co.)—Desulfurizing light petroleum hydrocarbons using unreduced nickel-alumina and hydrogen.
2,516,877 (Gulf Research & Development Co.)—Desulphurizing, using nickel oxide and hydrogen.
2,518,236 (Sun Oil Co.)—Separating two aromatic hydrocarbons with activated carbon.
2,518,304 (Phillips Petroleum Co.)—Gas distributor for pebble heaters.
2,518,353 (Union Oil Co. of Calif.)—Continuous separation of nitrogen bases from hydrocarbon oil solutions.
2,518,365 (Socony-Vacuum Oil Co.)—Wax separation by filtration.
2,518,677 (Shell Development Co.)—Separating hydrocarbons by urea in presence of wetting agent and electrolyte.
Re. 23,262 (Union Oil Co. of California)—Azeotropic distillation of toluene.
2,519,342-4 & 873-4 (Union Oil Co. of California)—Gaseous adsorption process using charcoal.
2,520,006 (Standard Oil Development Co.)—Vapor-liquid solvent extraction using phenol.
2,520,391 (Phillips Petroleum Co.)—Liquid-liquid contacting.
2,520,407 (Sun Oil Co.)—Removing inorganic matter from petroleum residue.
2,520,712 (Shell Development Co.)—Catalytic removal of acetylenes from olefins.
2,520,715-6 (Shell Development Co.)—Separating hydrocarbons by means of urea and thiourea.

Chemicals

2,516,848 (Electronized Chemicals Corp.)—Butadiene from petroleum by cracking, reacting with sulfur and bombarding with high speed electrons.
2,516,849 (Electronized Chemicals Corp.)—Butadiene from alcohols.
2,516,913 (Tide-Water Associated Oil Co.)—Addition products of aliphatic acid esters of o-phosphonic acid and dialiphatic aminomethyl phenols.
2,516,940 (The Texas Co.)—Treating products of synthesis gas conversions.
2,517,934 (Phillips Petroleum Co.)—Alkyl disulfides.
2,518,017 (Sun Oil Co.)—1-Vinyl cyclohexene -3.
2,518,235 (Shell Development Co.)—Hydrogenation of carbohydrates (starch) to sorbitol.
2,518,245 (Shell Development Co.)—Copolymers from alkylene glycols and di-(hydroxyalkyl) sulfides.
2,518,379 (Standard Oil Development Co.)—Metal-containing organic compound of sulfur.
2,518,397 (Socony-Vacuum Oil Co.)—Production of aliphatic nitriles.
Re. 23,254 (Gulf Research & Development Co.)—Depolymerizing dimer to produce isobutylene.
2,518,579 (Universal Oil Products Co.)—Resinous product by reacting allyl ether of a hexose carbohydrate with unsaturated ester of dicarboxylic dienophylic acid adduct.
2,518,528 (Universal Oil Products Co.)—Aliphatic amines.
2,518,639 (Standard Oil Co.-Ind.)—Purifying sulfonic acids.
2,518,688 (Tennessee Eastman Corp.)—Converting hydrocarbons into acetylene in 2 heating stages.
2,518,754 (Phillips Petroleum Co.)—Amines by reacting ammonia, carbon monoxide and hydrogen.
2,518,940 (Shell Development Co.) — Glycol diesters of aromatic acids.
2,519,061 (Standard Oil Development Co.)—Hydration of ethers.
2,519,092 (Standard Oil Development Co.)—Styrene-isobutylene copolymer.
2,519,099 (Phillips Petroleum Co.)—Alkyl aromatic hydrocarbon.
2,519,100 (Standard Oil Development Co.)—Curing isobutylene-diolefin copolymers.
2,519,249 (Phillips Petroleum Co.)—Carboxyethyl cellulose ethers.
2,519,309 (Socony-Vacuum Oil Co.)—Oxygenated naphthenes.
2,519,317 (Ethyl Corporation)—Chlorofluoronitro aromatic compounds as fungicides.
2,519,403 (Shell Development Co.)—Sulfonyl derivatives of di-tert-alkyl peroxides.
2,519,576 (Universal Oil Products Co.)—Arylindane hydrocarbons.
2,519,586 (Standard Oil Co.-Ind.)—Conversion of olefins and disulfides to di-thioethers.
2,519,691 (Socony-Vacuum Oil Co.)—Hexachlorohexane.
2,519,796 (Phillips Petroleum Co.)—Milling rubbery hydrocarbon polymer with resinous residue from polymerization of cracked gasoline.
2,519,930 (Gulf Research & Development Co.)—Recovering sulfonates of oil-soluble sulfonic acids from acid treated hydrocarbons.
2,519,955 (Shell Development Corp.)—Methane oxygen mixtures.

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Patent Trends

2,520,097 (Shell Development Co.)—Alkyl pyridines.
2,520,181 (Sinclair Refining Co.)—Amines and nitriles from ammonia and olefins.
2,520,490-1 (Phillips Petroleum Co.)—Sulfenamides and thiosulfenamides.
2,520,733 (Shell Development Co.)—Polymers of trimethylene glycols.

Hydrocarbon Synthesis

2,517,035-6 (The Texas Co.)—Catalysts for hydrocarbon synthesis.
2,517,177 (American Magnesium Metals Corp.)—Hydrogen by converting CO with steam.
2,518,315 (Standard Oil Development Co.)—Hydrocarbon synthesis using fluidized iron catalyst.
2,518,337 (Standard Oil Development Co.)—Slurry handling in hydrocarbon synthesis.
2,518,775 (Phillips Petroleum Co.)—Combined hydrocarbon conversion-hydrocarbon synthesis process.
2,519,284 (Phillips Petroleum Co.)—Absorbing CO in cuprous salt in o-anisidine.
2,520,860 (Steinschlaeger)—Water gas and like synthesis gases.

Lubricants

2,516,844 (Standard Oil Co.-Ohio)—Lube containing P_2S_5 treated olefinic hydrocarbon.
2,516,914 (Tide-Water Associated Oil Co.)—Emulsification-inhibited polyacrylate-containing oil compositions.
2,518,351 (Socony-Vacuum Oil Co.)—N-(thiophenalkyl) arylamines in mineral oil.
2,518,372 (Socony-Vacuum Oil Co.)—Alkyl substituted thiophene sulfonic acid salts as detergents in mineral oils.
2,518,529 (Standard Francaise des Petroles)—Alkylated benzene synthetic lubricant.
2,519,868 (Sinclair Refining Co.)—Lubricating oil dye.
2,520,101 (Socony-Vacuum Oil Co.)—Sulfurized unsaturated ketones.
2,520,748 (Shell Development Co.)—Polymeric oxide lubricant containing organic disulfide.

Catalysts

2,516,967 (International Minerals & Chemicals Corp.)—Inorganic oxide hydrogel pellets.
2,518,714 (Union Oil Co. of Calif.)—Four component alumina base catalyst.
2,519,622 (Shell Development Co.)—Protection of high surface xerogels with vapors of organic nitrogen base.
2,520,439 (Phillips Petroleum Co.)—Wet grinding process for aluminum halide catalyst.

Specialties

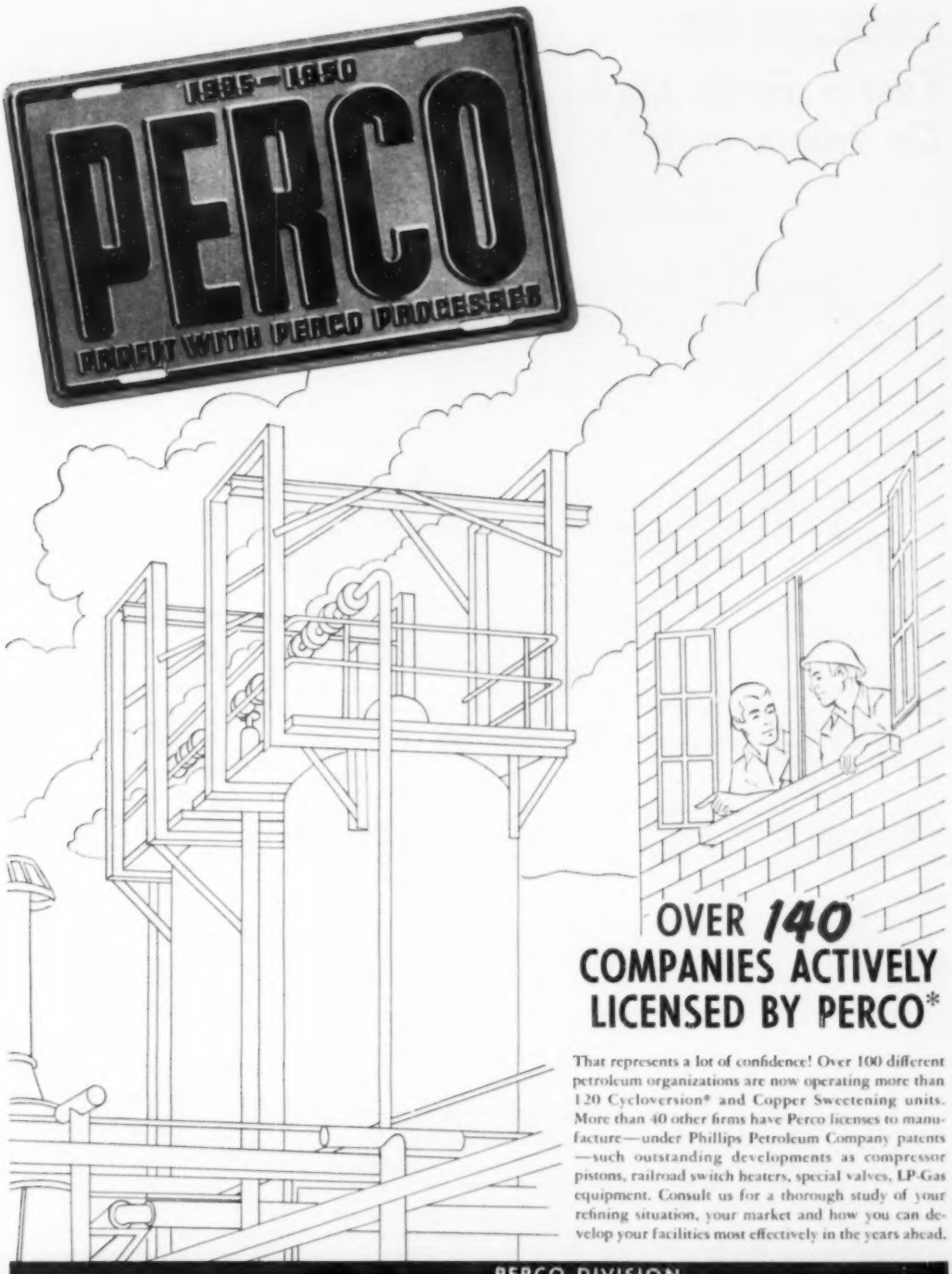
2,516,838 (Shell Development Co.)—Water-soluble oil base.
2,517,564 (Shell Development Co.)—Asphalt composition containing polysulfide.
2,520,356 (Tide-Water Associated Oil Co.)—Inhibiting corrosion of ferrous metal.
2,520,720 (Shell Development Co.)—Bituminous composition with ammonia, etc.

Miscellaneous

2,517,504 (Phillips Petroleum Co.)—Water purge to waste heat exchangers.
2,519,081 (Standard Oil Development Co.)—Determining rate of composition change.
2,519,770 (Phillips Petroleum Co.)—High-pressure vessel.
2,520,058 (Socony-Vacuum Oil Co.)—Measuring extent of oil saturation of porous materials using Co^{58} di-dodecyl ester of tetrahydro o-phthalic acid.
2,520,302 (Sun Oil Co.)—Pressure regulator for float systems.

How to Obtain Patents

Readers may obtain copies of any U. S. patent from the Patent Office at 25 cents each. Order by patent number direct from the Commissioner of Patents, Washington 25, D. C.



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Tester Finds Leaks in Tubes Or Joints in Heat Exchangers

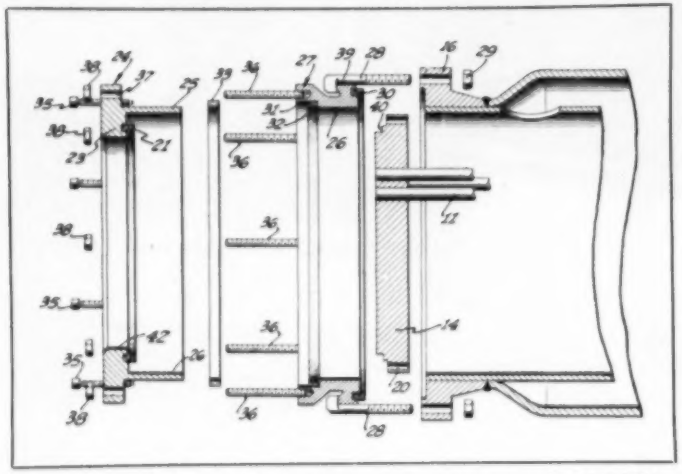


FIG. 1—Exploded view of leak tester for heat exchangers (U.S. 2,517,921)

HEAT EXCHANGER LEAKS in the joints between the tube sheet and the tubes or in individual tubes themselves can be detected by means of a simple testing device patented recently. The device is easily attached to the open, or floating tube-sheet, end of an exchanger housing and permits rapid visual inspection. It does not require use of expansible plugs for the tube-sheet bolt holes, and it can be left in position while a defective joint is re-rolled or a defective tube is plugged or replaced.

It is best described by referring to the exploded view in Fig. 1, showing the floating sheet 14, some tubes 11, and the exchanger housing flange 16, with the regular closure flange removed. The test device is used as follows.

Seal ring 30 is placed in position on test device body member 27 and this then is moved adjacent the open end of the exchanger. Hook bolts 28, which engage a flange on member 27, hold it and flange 16 in alignment and clamp seal ring 30 in between. Then seal ring 32 is placed in recess 31 and a metal follower ring 33 is placed behind seal ring 32. Sleeve member 24 is moved into place over projecting stud bolts 36, with projection 25 extending into the bore 26.

Seal ring 21, carried on flange 23 of sleeve 24, rests on annular groove 40 on the floating tube sheet 14. This ring seals bolt holes 20 on the tube sheet. Nuts 38 are then threaded on studs 36 to clamp seal ring 21 in place. Seal ring 32 is expanded into sealing relation by threading crowder bolts 35 through sleeve 24.

The housing interior is then put under fluid pressure by admitting water or other fluid through the regular exchanger inlet fitting. It may be desirable to inject gas instead of water in some instances. The full normal operating pressure of the exchanger can be used for test purposes.

Leaks occurring around the ends of any of the individual tubes 11 will indicate a defective joint at the tube sheet. Fluid escaping from the end of any particular tube shows a leak in the wall of that tube.

U. S. 2,517,921, issued August 8, 1950, to James R. Phares, assignor to C. F. Braun & Co., Alhambra, Calif.

Viscosimeter Operates Inside Process Unit during Reaction

A VISCOSIMETER has been designed to be permanently installed on a process vessel and to provide a record of viscosity measurements of the liquid material within the vessel during process operations. It is particularly adaptable for use on vessels or lines operating under positive pressure.

The instrument consists of a torque tube of predetermined length and torque characteristics, which extends into the vessel with a paddle wheel type impeller on the inside end. A hollow motor shaft of sufficient strength and rigidity to be unaffected by the twist of the torque tube is secured to that tube and also extends through the vessel wall. A constant speed motor is connected to the hollow shaft so as to drive the torque tube and impeller at a constant predetermined speed. A strong rod within both the torque tube and hollow motor shaft is attached to the impeller. This rod is sufficiently sturdy to resist torque twist and will accurately reflect the rotation of the impeller.

Suitable indicating devices are attached to the outside end of the motor shaft and rod for measuring the angle of twist between the undeformed rod and the deformable torque tube when the impeller is rotated in the liquid in the vessel. A temperature indicator is necessarily included and installed adjacent the impeller assembly.

U. S. 2,519,378, issued August 22, 1950, to Myron O. Kilpatrick, assignor to Phillips Petroleum Co., Bartlesville, Okla.

Patents Issued in August

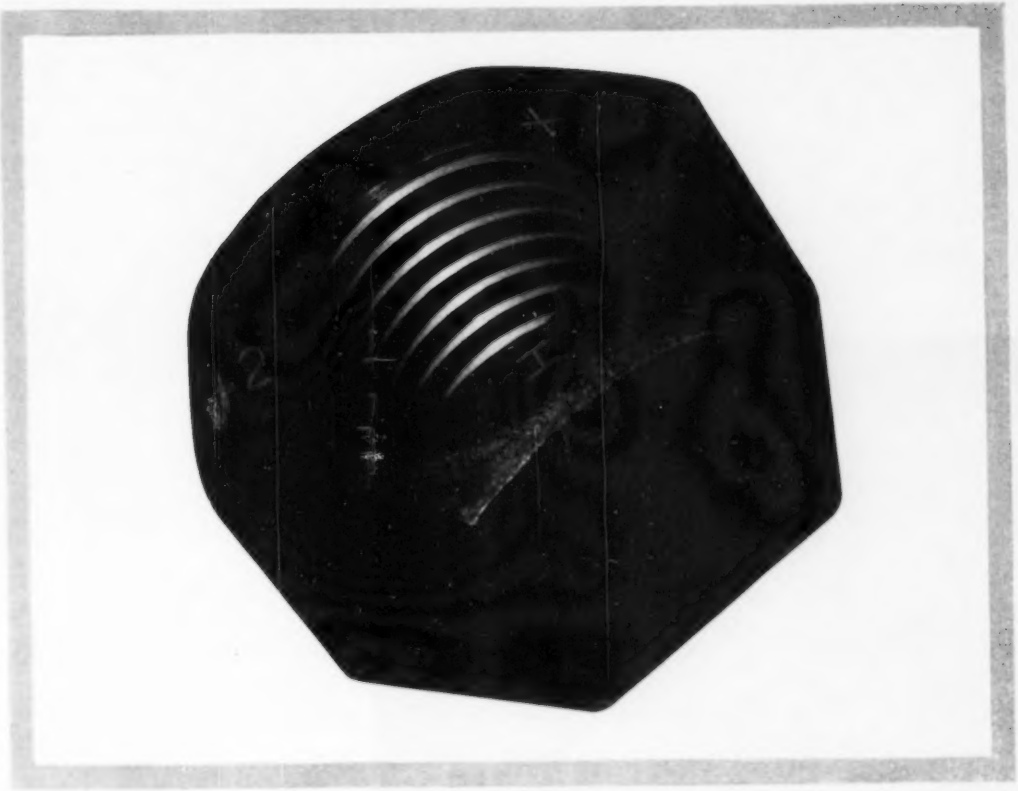
The following classified listing covers patents issued during the month of August believed to be of interest or value to petroleum processing or handling operations.

Catalytic Reactors

2,516,943 (The Texas Co.)—Catalytic reactor for cracking, reforming, dehydrogenation, or desulfurization.
2,517,339 (Gulf Research & Development Co.)—Moving bed catalytic cracking apparatus and method.
2,517,525 (Sun Oil Co.)—Catalytic reactor of the fixed bed type.
2,518,270 (Standard Oil Development Co.)—Fluid type catalytic reactor with standardized, removable heat exchange elements.
2,518,583 (Universal Oil Products Co.)—Catalytic conversion apparatus of the fixed bed type.
2,518,693 (Standard Oil Development Co.)—Fluid type catalytic cracking unit.
2,519,150 (Gulf Oil Corp.)—Catalyst stripper.
2,520,482 (Socony-Vacuum Oil Co., Inc.)—Insulated conduit.
2,520,717 (Socony-Vacuum Oil Co., Inc.)—Catalytic contacting vessel.

Processing, general

2,516,892-3 (Universal Atlas Cement Co.)—Refractory concrete.
2,516,974 (Texaco Development Corp.)—Equipment for the gasification of carbonaceous material to fuels.
2,517,626 (Solomon Berg)—Hollow repair device for leaky boiler tubes.
2,517,639 (The Fluor Corp.)—Cooling tower water distribution system.
2,518,304 (Phillips Petroleum Co.)—Gas distributor for pebble heaters.
2,518,746 (The Fluor Corp.)—Bubble cap.
2,518,760 (The Fluor Corp.)—Air-cooled heat exchanger.
2,518,845 (E. A. Kent)—Boiler feed water deaerator and corrosion control equipment.
2,519,084 (Westinghouse Electric Corp.)—Shell and tube heat exchanger having zig-zag tubes.
2,519,315 (Socony-Vacuum Oil Co., Inc.)—Apparatus and method for heating granular solids.
2,519,600 (Thomas N. Pinion)—Boiler water feed device.



Hot Forged for Strength

There's no cause for concern about premature nut failure when you use the Bethlehem Quenched Nut in high-temperature, high-pressure bolting applications. For this nut can take it.

The Bethlehem Quenched Nut has the ability to stay on the job for long periods of time because of its built-in strength. This is the result of hot forging. Instead of being punched from a hot bar, as is the case with ordinary nuts, the Quenched Nut is made by forging and extruding hot metal into a forming die, after which it is quenched and tempered. This results in a nut sufficiently strong to break virtually any stud or bolt on which it is used.

Besides, the Quenched Nut has a tough grain structure, and its oxidized sides are resistant to corrosion. In addition, it has a ground bearing surface which is vastly superior to common, machined surfaces.

The Quenched Nut is a product of Bethlehem's fastener plant at Lebanon, Pa. It conforms to Grade 2H of ASTM Specification A194, and is carried in stock in bolt sizes from ⅜ in. to 3½ in. Lebanon Plant also stocks nuts in Grades 0, 2, and 4. If you'd like additional information about the Quenched Nut, or any of the other Bethlehem fastener items for high-temperature bolting, put it up to a Bethlehem man, or write to us at Bethlehem, Pa.

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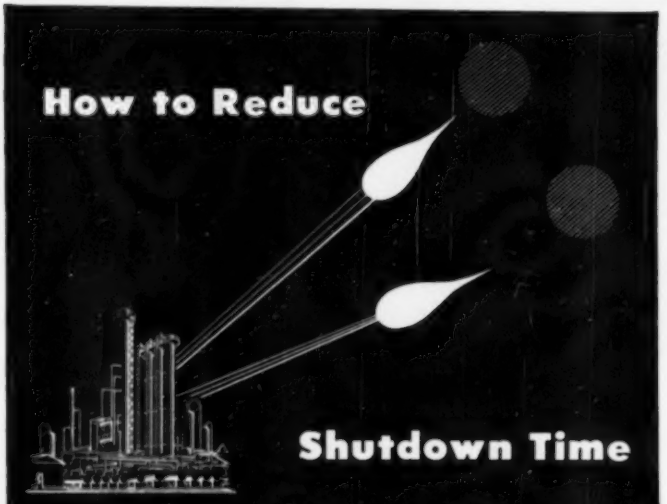
BETHLEHEM STEEL

Bethlehem supplies every type of Fastener

2,519,616 (Universal Oil Products Co.)—Furnace for oxidation and combustion reactions at high temperatures and high pressures.
2,519,618 (Shell Development Co.)—Evaporator and fluid contact apparatus.
2,519,696 (John B. Orr, Jr.)—Tube cracking furnace.
2,519,776 (Phillips Petroleum Co.)—High-pressure vessel.
2,519,873-4 (Union Oil Co. of Calif.)—Adsorption apparatus and process.
2,520,096 (Babcock & Wilcox Co.)—Fluid heater and reactor unit.
2,520,391 (Phillips Petroleum Co.)—Liquid-liquid contacting vessel.
2,520,494 (George A. Dalin)—Distillation column.
2,520,637 (Selas Corp. of America)—Apparatus for heat-treating granular materials.
2,520,755 (Brown Fintube Co.)—Multiple tube heat exchanger.
2,520,864 (Thornhill-Craver Co.)—Closure for pressure vessels.

Instruments

2,517,033 (The Bristol Co.)—Thermocouple structure.
2,517,081 (Taylor Instrument Cos.)—Control system with automatic response adjustment.
2,517,121 (General Motors Corp.)—Automatic spectrophotometer.
2,518,244 (Moore Products Co.)—Pneumatic control apparatus.
2,518,540 (Donald C. Green)—Pressure gage.
2,518,654 (Louis P. Backus)—Automatic control for boiler feed pumps.
2,518,832 (The Fluor Corp.)—Pulsation dampener for pressure gages.
2,519,081 (Standard Oil Development Co.)—Apparatus and process for determining rate of composition change.
2,519,262 (Bell Telephone Laboratories, Inc.)—Differential analyzer.
2,519,378 (Phillips Petroleum Co.)—Apparatus for measuring viscosity of liquid material during treatment.
2,519,416 (James A. Townsend)—Liquid rate-of-flow indicator.
2,519,481 (Benjamin Clayton, Refining Unincorporated)—Temperature control of chemical reactions.
2,520,302 (Sun Oil Co.)—Pressure regulator for float systems.
2,520,468 (Moore Products Co.)—Pneumatic control apparatus.



In any cooling water system there are scores of places where scale and corrosion can cause trouble and severe damage. Cleaning, maintenance and replacement of condensers, heat exchangers, coolers, piping and other equipment all represent a considerable loss, both in time and money. Losses can be reduced to a minimum, or eliminated entirely, by the proper application and control of treatment chemicals.

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COOLING WATER CONDITIONING • BOILER WATER CONDITIONING

Valves and Fittings

2,516,947 (Orbit Valve Co.)—Seat for high fluid pressure valves.
2,517,194 (Phillips Petroleum Co.)—Vapor pressure relief system.
2,517,562 (Ray F. Hanson)—Relief valve.
2,517,858 (Victor W. Farris)—Safety valve.
2,518,443 (Chiksan Co.)—Quick detachable swivel joint.
2,518,790 (The Duriron Co., Inc.)—Plug valve.
2,519,333 (Fluid Control Engineering Co.)—Fluid flow control device.
2,519,541 (Fluid Control Engineering Co.)—Valve construction.
2,519,574 (James W. F. Holl)—Rotary fluid valve.
2,519,798 (A. W. Cash Co.)—Pressure regulating valve.
2,520,069 (Robert Simpson)—Mixing valve.
2,520,213 (C. M. Kemp Mfg. Co.)—Gas proportioning equipment.
2,520,215 (Ralph C. Kern)—Pipe union.
2,520,364 (James C. Hobbs)—Gate valve.

Tools

2,516,854 (Joseph B. Christian)—Gaging apparatus for aligning shafts.
2,517,041 (William G. Sisley)—Pivoted jaw pipe wrench having pivoted spring-biased auxiliary jaws.
2,517,729 (Simon Smith)—Pipe wrench having anti-swing detent for adjustable outer jaws.
2,517,921 (C. F. Braun & Co.)—Leak tester for heat exchangers.
2,517,941 (William E. Stubbs)—Hydraulic wrench.
2,519,630 (High N. Boyer)—Plier wrench.
2,519,973 (Lawrence C. Mead)—Wrench type pliers.

Pumps & Compressors

2,517,367 (Winkler, Mergenthaler, Inc.)—Gas compressor.
2,517,477 (Combustion Engineering-Superheater Inc.)—Composite wear ring for centrifugal pump impellers.
2,519,531 (The Lummus Co.)—Gas ejector apparatus.
2,519,642 (Reginald Clarence Ford)—Positive displacement pump without valves, stuffing boxes, or glands.
2,519,674 (C. F. Lumb and F. G. W. Spears)—Boiler tube cleaning blower.
2,520,880 (A. O. Smith Corp.)—Centrifugal pump.

Tanks

2,518,488 (Chicago Bridge & Iron Co.)—Hanger for a seal in a floating roof tank.
2,520,883 (Linde Air Products Co.)—Container for liquefied gases.

Miscellaneous

2,516,948 (Maxim Silencer Co.)—Water cooled silencer.
2,516,949 (Maxim Silencer Co.)—Muffler with inner sound absorbing tube.
2,519,967 (Charles L. Jones)—Carbon dioxide fire extinguisher.

How to Obtain Patents

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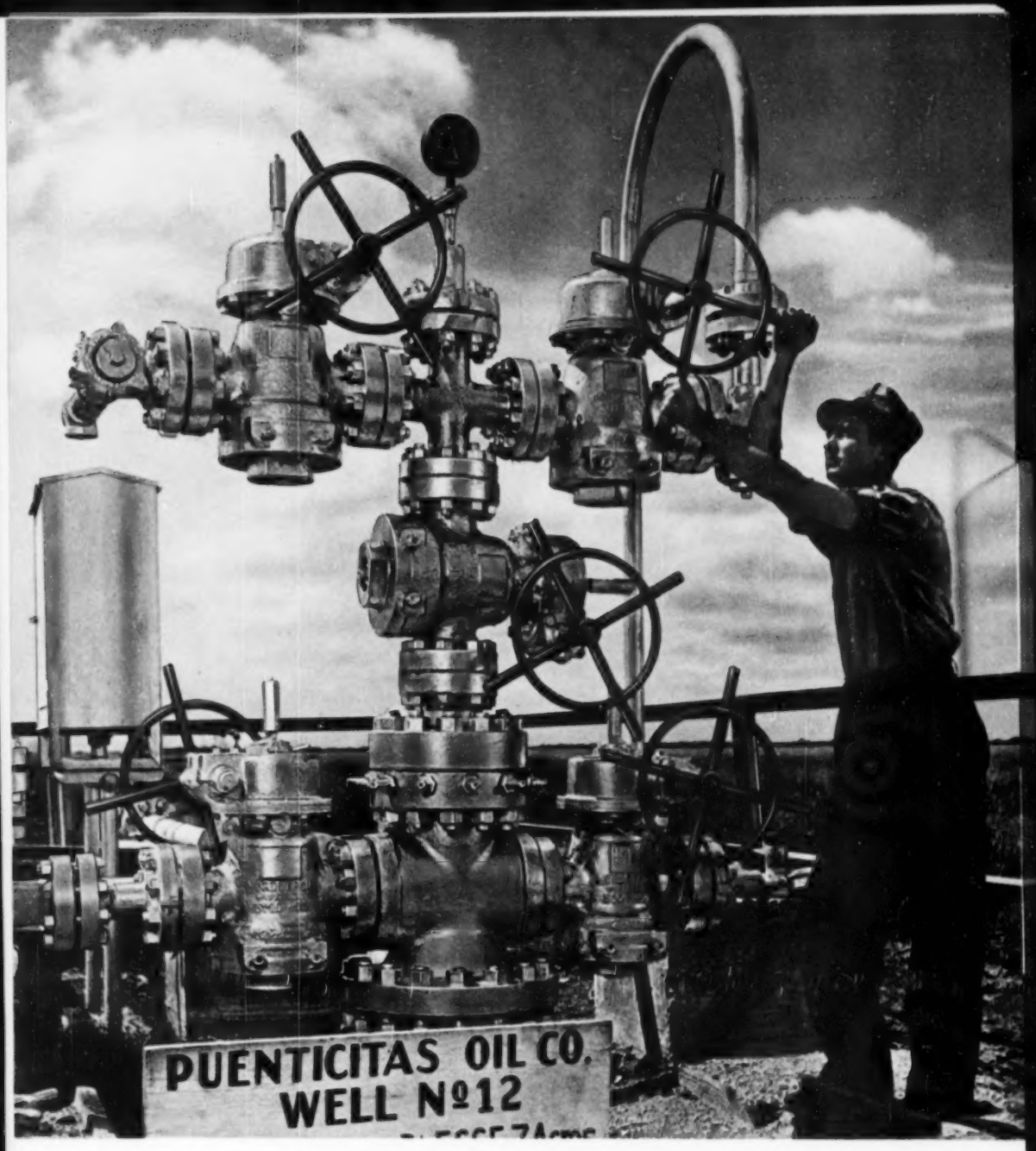

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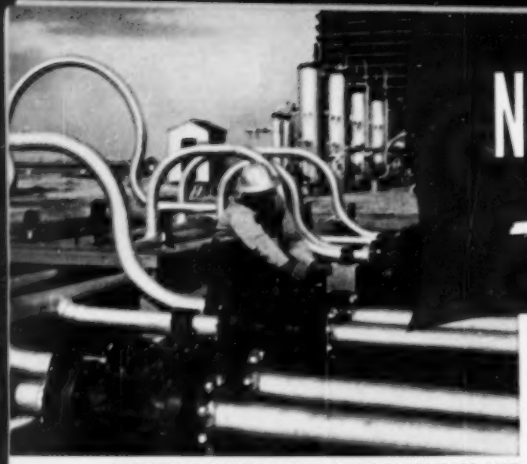
Nordstroms fit the Need —*Unsurpassed*

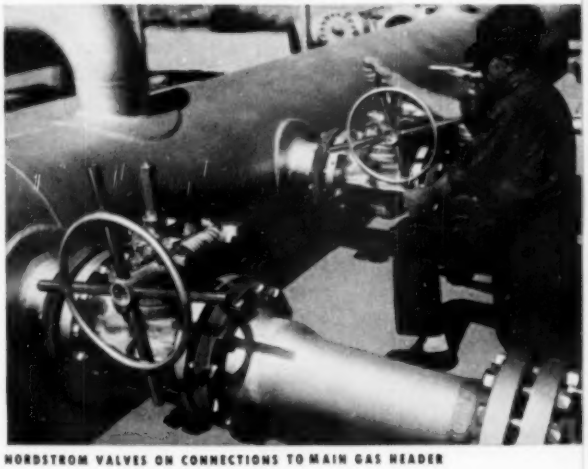


NORDSTROM VALVES IN FIELD PLANT COMPRESSOR LINE

FIELD PRODUCTION MANIFOLD, NORDSTROM EQUIPPED

NORDSTROM VALVES IN MAIN GAS COMPRESSOR STATION

NORDSTROM MUDLINE VALVES ON OFF-SHORE DRILLING BARGE



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NEWS OF

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Serving the Petroleum Processing Industry

Magnaflux Corp. Moves Into New Offices and Laboratory in Dallas

A new office serving the entire Southwest and an inspection laboratory for local inspection work has been opened by the Magnaflux Corp. at 2823 Manor Way, Dallas. The previous Dallas office was destroyed by an aircraft crash last November. Magnaflux inspection is one of the several non-destructive testing methods used and sold by the company for inspection of parts during manufacture or overhaul, to insure that the parts are free from discontinuities which would cause failure during production or in use.

American Cyanamid Moves Plant Site

American Cyanamid Co. announced that it has purchased a plant site in Michigan City, Ind., and will soon begin construction of a $3,000,000 plant at this location. The new plant will produce cracking catalysts for the important segments of the petroleum industry located in the Midwest and along the Eastern seaboard. Although Cyanamid originally purchased a plant site in East Chicago, Ind., and announced that it would construct the new plant there, requirements for additional production capacity for a number of the company's products have made it necessary for them to change its plans and locate the plant on a larger site in Michigan City.

General American Opens New Division

A new plate and welding division office has been opened by the General American Transportation Corp. in Tulsa, Okla. J. D. Camp will represent the company for the sales of all fabricated equipment as well as Wiggins Conservation Structures and Wiggins Gasholders. His office will be located in the First National Bldg. He has been associated with General American, as a sales representative, since completing active duty in the U. S. Navy.

Chiksan Moves Sales Headquarters

Chikran Co., Brea, Calif., has established its sales headquarters for the Rocky Mountain area in Salt Lake City with B. P. Ragsdale in charge. Their Rocky Mountain headquarters were formerly located in Denver, with Al Myers as sales representative. Mr. Myers has resigned to enter business for himself. Mr. Ragsdale, who served the company in the engineering department, as service representative and sales engineer in the Southern California territory, will handle sales and service on Chiksan, WECO, Anchor and Okadee products.

Foxboro Opens Two New Offices

The opening of two new offices by the Foxboro Co. brings the total of its domestic offices to 39, of which three include branch factory facilities. The newest addition is the branch office at 214 West 10th St., Wilmington 1, Del., under the managership of Kenneth L. Barton. Earlier this year an office was opened at 225 South 5th St., Minneapolis 2, Minn., with Robert C. Cahill as resident engineer. Mr. Cahill has been transferred from the company branch at Appleton, Wis.

McKee Appoints Two in Sales

Arthur G. McKee & Co., Cleveland, have appointed Myran J. Livingston sales manager of the petroleum refining division and Jerry Brennan sales engineer. Mr. Livingston, who has been in charge of the sales office in New York for the past six years, will be located at the headquarters in Cleveland. Mr. Brennan, former New York representative of Sivyer Steel Castings Co., will be placed in charge of the New York office.

Lunkenheimer Names Secretary

Mr. Lunken

Edmund P. Lunken, vice-president of Lunkenheimer Co., has been elected secretary. He succeeds Charles W. Burrage who resigned to devote full time to sales as manager of sales engineering.

A graduate of Yale University, Mr. Lunken has been associated with the company since 1936. For two years he worked in various jobs at the factory, was later made a sales engineer and was appointed vice-president in 1945. He served in the Army Air Corps during World War II and was released from active duty as a Lt. Colonel.

Mr. Burrage, a graduate of Harvard University, has been with Lunkenheimer since 1924. Prior to that he served as an instructor at M.I.T., worked in the engineering department of Manning, Maxwell & Moore, Inc., and was chief engineer of the Nelson Valve Co.

W[redacted]?

1st Let's start to summarize:

You can obtain Wolverine condenser tube in any copper base alloy that will meet your particular requirements and working conditions. Here is the list available from our Mills.

Copper	*Cupro-Nickel 10%*
Admiralty	*Aluminum Brass*
Arsenical Copper	*Aluminum Bronze*
Cupro-Nickel 30%	*Nickel Aluminum Bronze*
Cupro-Nickel 20%	*Muntz Metal*
Red Brass	

Our Engineering Department is always ready to help you determine the proper alloy that will perform best under the conditions that prevail in your operations.

2nd

The tube can be delivered to you in a wide range of diameters and lengths . . . Diameters range from ⅝ to 2 inches.

In our next message to you we shall emphasize more reasons why it pays to specify Wolverine condenser tubes, and why Wolverine should be considered in any contemplated tube purchases.

Send for Our Condenser Tube Brochure

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Calumet & Hecla Consolidated Copper Company
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PLANTS IN DETROIT AND DECATUR, ALA.
Sales Offices in Principal Cities

Hammel-Dahl Names Two Officials

Hammel-Dahl Co., automatic control equipment manufacturers, Providence, R. I., have appointed two new vice presidents: John O. Tragard, in charge of sales and contracts; and Maurice MacDonald, vice president and manager of engineering.

Mr. Tragard

Mr. Tragard

Mr. MacDonald

was with Foxboro Co. for 20 years as sales executive and legal counsel, and with Fulton Sylphon Division of Robertshaw-Fulton Controls four years. A graduate of Northeastern University and Harvard College, he was admitted to the Massachusetts Bar in 1936.

Mr. MacDonald came from M. W. Kellogg Co., whom he joined in 1932 and where for the past eight years he has been chief engineer in charge of instrumentation and control. He received a certificate of appreciation from the Office of Scientific Research and Development for service in pioneering development of oxygen plants during World War II. He appears as inventor on several patents and as author of articles dealing with instrumentation.

Marley Appoints New Sales Manager

Roy W. Maze, public relations director for the Marley Co., Inc., has been promoted to merchandising sales manager. Mr. Maze, a graduate of the College of Emporia with a M. S. degree from Kansas State College, followed college with five years of teaching and administrative work in high schools. In 1942 he joined the engineering department of the Aireon Corp., and two years later joined the U. S. Army. He was later transferred to the Navy and now holds a reserve commission. He joined Marley in 1946 when he left the service.

Foster Wheeler Elects Vice President

Lee Allan Swem, with Foster Wheeler Corp. since 1936, has been elected vice president in charge of the firm's new international division. This division will be responsible for foreign business and coordinate activities of subsidiary companies in Canada, England and France.

Rockwell Adds New Project Engineer

R. Chris Nitschke, formerly with Arthur G. McKee & Co., has joined the Rockwell Manufacturing Co. as a project engineer on petroleum products. At one time he was associated with the old Standard Vacuum Oil Co. as assistant chief engineer. From 1941 to 1943, he headed his own consulting engineering operation in New York, which was dissolved when he entered the armed services as a petroleum specialist. In 1946 he was located in South America as a project engineer for M. W. Kellogg Co. He received his basic engineering at Victoria College in England, and after coming to the United States did petroleum engineer-

Mr. Nitschke

CORROSION PROOF LININGS

There is an Atlas Corrosion Proof Lining to solve every corrosion problem. Atlas Linings are based on many different plastics as well as natural and synthetic rubber. Installed at Atlas or customers plant.

CORROSION PROOF CEMENTS

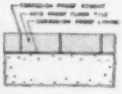
Each Atlas Corrosion Proof Cement has physical and chemical properties best suited for specific applications. Consult Atlas Technical Service to insure usage of the most durable and economical cement.

PROTECTIVE COATINGS

Atlas offers a complete line of Corrosion Proof Protective Coatings. The recommendations of a coating most suitable for customers application is a regular Atlas Service.

CORROSION PROOF INDUSTRIAL FLOORS

Composed of acid and alkali proof brick or tile and acid and alkali proof cement. The choice of materials involves a thorough study of conditions and materials being handled. Our Engineering Department will be pleased to help without charge or obligation.



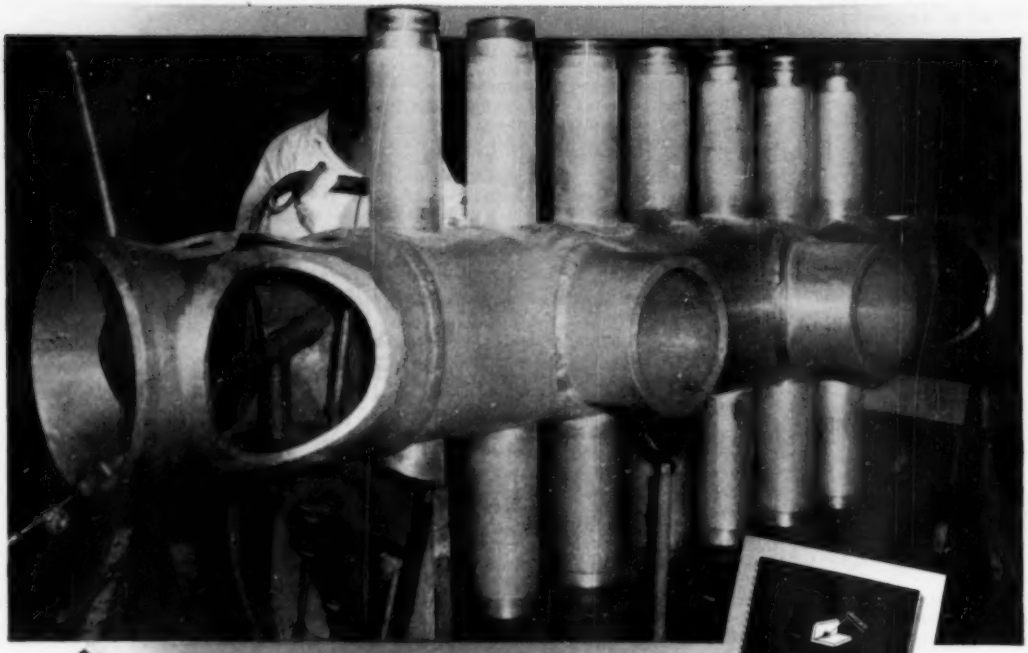
THE ATLAS MINERAL PRODUCTS COMPANY

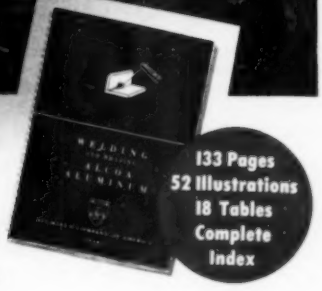
MERTZTOWN, PENNA. HOUSTON, TEXAS

Helpful Guides To the selection of acid-alkali-solvent proof CONSTRUCTION MATERIALS

Write for your copy General Bulletin MCC No. 1

Contains information on Atlas' complete line of Chemical Construction Materials. Write to 19 Walnut St., Mertztown, Pa.





Tough to fabricate? Expensive?

Not when you use the methods described in this new Alcoa booklet

Some of the nozzles and laterals on this aluminum header have 1½-inch wall sections. Yet welding was easy with the methods described in this booklet. Joints are tight and smooth. Fabrication costs were low.

And note the simple wooden trestles supporting the assembly . . . dramatic evidence of aluminum's light weight and ease of fabrication.

The equipment shown here is to be used in sub-zero production of oxygen . . . an ideal application for aluminum. For, the lower the temperature the better the performance you get from aluminum. As temperatures drop from 75 degrees F. to minus 320 degrees F., Alcoa 35 alloy gains 23% in yield strength, 80% in elongation, and 67% in tensile strength.

If you want to know more about low-cost fabrication of aluminum, write for a copy of "Welding and Brazing Alcoa Aluminum". You'll find it helpful. And if you are considering design of new equipment in which aluminum might improve performance and lower costs, our engineers will gladly consult with you. Write ALUMINUM COMPANY OF AMERICA, 1477K Gulf Building, Pittsburgh 19, Pa.

ALCOA BRAZING **ALUMINUM**

ALCOA A C ALUMINUM O A ®

ing work at Columbia University and the University of Tulsa.

Porter Sells Quimby Pump Division

H. K. Porter Co., Inc., Pittsburgh, has sold its Quimby Pump Division to the Warren Steam Pump Co., Inc., and is withdrawing from the manufacture of screw pumps. T. M. Evans, Porter's president announced that the company planned to devote itself more fully to its other lines of business.

F&P Offers Instrumentation Course

The next instrumentation course offered by the Fischer & Porter Co. will be held at its Hatboro, Penn., plant from Oct. 9 through the 13th. This course will cover manufacture, calibration, installation, operation and maintenance of primary and secondary process control instruments. Further details can be obtained by writing to the company at East County Line Rd., Hatboro, Penn.

News of Personnel

A. O. Smith Corp.—J. J. Bohmrich, former manager of the product service division, has been named group executive over the product service, railroad products and welded electrode and equipment divisions. J. W. Spoor, former assistant manager, replaces Mr. Bohmrich as manager. E. R. Dickenson, who has been manager of the Chicago branch, is being transferred to the Eastern branch at Union, N. J., succeeding C. L. Tracey who is moving to the New York district office in LPG sales in the home appliance division. At the Dallas branch, J. A. Snyder, Jr., was named manager, succeeding D. R. Neff who has resigned.

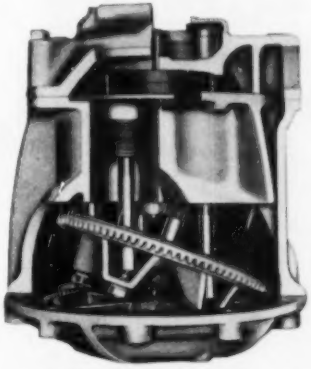
Arthur G. McKee & Co. — R. P. Mase has been appointed Southwest sales representative of the company's petroleum refining division. He will be located in Tulsa. Mr. Mase has been a petroleum engineer for the past 25 years, and for the past ten years has been chief engineer in the engineering and construction division of Jones & Laughlin Supply Co., Tulsa.

United States Rubber Co.—J. Scott Brown has been appointed chief engineer of the Naugatuck chemical division. He will supervise engineering operations in the synthetic rubber plants at Naugatuck, Conn., Port Neches, Texas, and Borger, Texas; the Marvinol vinyl resin plant at Painesville, Ohio; and the Naugatuck chemical plant at Naugatuck. Mr. Brown first came to U. S. Rubber in 1942. Prior to this, he was employed by Carbide and Carbon Chemical Corp. and the Blaw Knox Co.

A NEW LIQUID PROCESSING METER

This new member of the Bowser Xacto meter line was developed to meet the needs of many of our customers for highly accurate measurement of a wide variety of liquids at flow rates to 110 g.p.m. It is available with counters to meet any processing need.

To eliminate metal-to-metal contacts at friction points, either special hard carbon or stainless steel construction is used. Castings—gray iron or bronze.



In many liquid processing operations Bowser Xactos have proved to be the best answer when rising costs had to be offset by every possible production economy.

BOWSER ESTABLISHED 1885

Write today--

. . . for your copy of the new folder on Bowser processing meters. It may spark some ways to cut operating costs in your plant.

BOWSER, INC., 1329 Creighton Ave., Fort Wayne 2, Ind.

SERVING LIQUID PROCESSORS SINCE 1885

[To obtain more data on advertised products see page 1116]

YOUR EASIEST WAY TO
LOW-COST OPERATION
When centrifugal pumps are proportioned in size to their duties, costs are kept to a minimum. Eastern Industrial Pumps do an efficient job. Weight, space, power, and costs are reduced. Heavy-duty application with trouble-free performance is yours with minimum operating costs.
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FREE Eastern Centrifugal Pump Catalog 100. 12-page, 2-color catalog offers engineering data, charts and illustrations, packed with helpful suggestions.
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"TUSKO" WALRUS POLISHING LEATHER
No "weak sister" here, when the menace is thin solvents. Bring on gasoline or other petroleum distillates—Palmetto self-lubricating Pelro packs the punch of a typically unique Palmetto lubricant compound which "sizes the packing" . . . which is neither soluble nor miscible in chlorinated hydrocarbons, petroleum solvents or coal tar derivatives. Impregnation of every strand absolutely ensures an end to all capillary seepage!
Count on Palmetto Pelro for its economical performance too! Finest structure of finest materials cuts the extravagant man-hour loss in frequent repacking — and equipment failure — due to faulty makeshift packing.
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GREENE, TWEED & CO.
NORTH WALES, PENNSYLVANIA
Contact your fully-stocked Palmetto distributor on all packing problems . . . ask him about our special tools.

News of Suppliers

Mathieson Chemical Corp.—R. B. Worthy, vice president, formerly general manager of both the Saltville, Va., and Baltimore, Md., operations, will now devote his entire time to the Saltville operations, where he will make his headquarters. Arthur T. Bennett, vice president, formerly general manager of SASCO operations, with headquarters in Houston, has been appointed general manager of the Baltimore operations. Joseph Mullen, Jr., has been appointed operating manager of the Little Rock, Ark., operations which consist of fertilizer and acid plants. H. T. Galt has been named operating manager at Little Rock. James S. Gilliam has been named operating manager, sulfur recovery operations, of the recovery plants at McKamie and Magnolia, Ark. R. T. Braun has been appointed operating manager of southwestern acid plants operations, consisting of sulfuric acid plants at Port Arthur and Beaumont, Texas, and Bossier City, La.. W. S. Miller has been named operating manager of the Houston operations, and John R. Beatty, assistant operating manager.

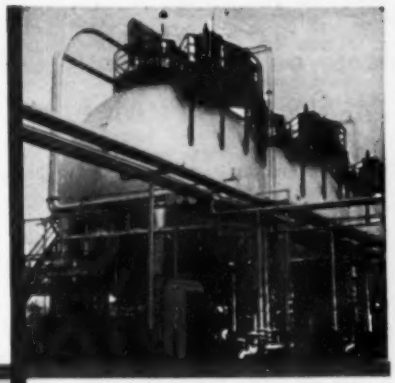
American Meter Co. — Archie E. Weingard has been appointed manager of production with headquarters located at the company's Erie plant. He first became associated with the American Meter in 1947 as supervisor of methods, later being made assistant to the vice-president. Mr. Weingard is a graduate of the General Electric Technical Engineering School. Following graduation he spent 16 years with General Electric and from 1943 to 1947 was superintendent of production control for the Lord Manufacturing Co.

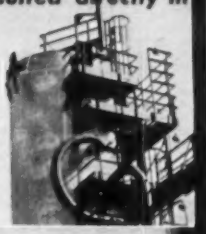
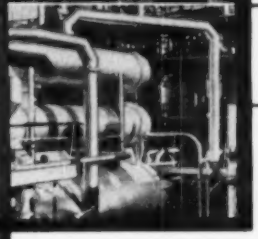
Johnson Pump Co. — Kenneth G. Lundie has been elected vice-president in charge of sales and Perry Brown vice-president in charge of engineering. Mr. Brown was formerly chief engineer and Mr. Lundie sales manager.

Nopco Chemical Co., Harrison, N. J., has announced that the manufacture of its chemicals will be located in Richmond, Calif., where they are converting two plants as part of their Pacific division expansion program. The plant at 1141 South 14th St. is being converted to the manufacture of stearates and palmitates by the Metasap Chemical Co., a wholly owned subsidiary. It is scheduled to go into production shortly after January 1. The second plant at 1140 South 10th St. is being fitted for the production of chemical processing specialties and agricultural products. Production is expected to begin shortly after the end of the second quarter, 1951.

PETRECO DESALTING

consistently delivers a crude charge with minimum salt and solid content. A recent survey of all Petreco Desalters operating in oil refineries throughout the United States and Canada disclosed that Petreco Desalting was showing a very rapid pay-out in terms of improved refinery operations. It showed that:



THESE OPERATING ADVANTAGES	resulted directly in	THESE PROFITABLE ECONOMIES
Higher cracking temperatures.		*Deeper cracking, increased gasoline yield.*
Less plugging in furnace tubes.		*Fewer tube failures, higher charge rates.*
Reduced corrosion in overhead equipment.		*Less shut-downs due to mechanical failures.*
Less plugging in exchangers.		*Lower clean-out costs, more efficient heat exchange, longer runs.*

These are not the *only* benefits to be derived from Petreco Desalting – they are the benefits consistently enjoyed by the majority of Petreco users. For complete information on Petreco Desalting get in touch with the nearest Petreco office.

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Role of Synthetics in Defense Is Topic At Annual API Meeting, Nov. 13-16

HOW synthetic fuels will play a part in defense will be discussed before the Refining Division's group session at the annual meeting of the American Petroleum Institute in Los Angeles next month.

The 30th annual API meeting—the first such meeting on the West Coast since 1941 and the first in Los Angeles in 15 years—will be held Nov. 13-16, with committee meetings starting Thursday, Nov. 9.

Only one group session of the refining Division will be held—on Wednesday afternoon, Nov. 15. Chester F. Smith, Standard Oil Co. (N. J.), will preside.

Two papers are scheduled for that session—one on "Synthetics in Defense" by James Boyd, Bureau of Mines, the other by Lawrence R. Hafstad, Atomic Energy Commission.

Another session of interest to refiners will be a panel discussion on "Establishing and Maintaining an Effective Fire-Control and Safety Program." It will be held Monday morning, Nov. 13, with F. R. McLean, Socony-Vacuum Oil Co., presiding. Panel speakers will include J. H. Myers, Atlantic Refining Co.; R. W. Black, Esso Standard Oil Co.; C. L. Hightower, United Gas Pipe Line Co.; W. O. Wilson, Standard Oil Co. (Ind.); and J. H. McKenzie, General Petroleum Corp.

Committee meetings and group sessions will be held in the Biltmore and Ambassador Hotels. The Biltmore Theatre, adjacent to the Biltmore Hotel, will be used for general sessions.

The two general sessions on the program will be held Wednesday and Thursday mornings, Nov. 15 and 16—both presided over by W. Alton Jones, president of Cities Service Co. and chairman of the API Board of Directors.

Frank M. Porter, API president, will address the first general session. Presentation of the API Gold Medal for Distinguished Achievement will also be made at the Wednesday general session, to an as yet unidentified recipient. The gold medal, awarded annually, was presented last year to J. Howard Pew, director and retired president of Sun Oil Co.

Scheduled to address the second general session, Thursday morning, are Benjamin F. Fairless, president of United States Steel Corp., and Reese H. Taylor, president of Union Oil Co. of Calif. Another speaker is to be announced.

A highlight of the annual gathering will be a banquet Wednesday night, Nov. 15, sponsored by West Coast oil men. Planned for 2,500 guests at the famous Hollywood Palladium Ball Room, it will be the first API banquet at an annual meeting since 1941. The local committee handling arrangements is headed by Arthur C. Stewart, of Union Oil Co. of California.

Committee meetings for the Division of Refining will be held Nov. 9 through the 14th, as follows:

Thursday, Nov. 9

Sludges and Clays (Subcommittee), 9:00 a.m.; J. A. Fowler, chairman.
Waste Gases and Dusts (Subcommittee), 10:00 a.m.; D. G. Stevens, chairman.
Chemical Wastes (Subcommittee), 1:00 p.m.; J. H. Easthagen, chairman.
Oil-Water Separation (Subcommittee), 2:00 p.m.; R. N. Giles, chairman.
Sampling and Testing—Waste Disposal (Subcommittee), 3:00 p.m.; R. J. Austin, chairman.
Emulsions (Subcommittee), 4:00 p.m.; W. E. Boden, chairman.

Friday, Nov. 10

Disposal of Refinery Wastes (Committee), 9:00 a.m.; L. C. Burroughs, chairman.
Safety and Relief Valves (Manufacturers' Subcommittee), 9:00 a.m.; L. P. Stillman, chairman.
Field-Assembled Vessels (Joint Subcommittee), 9:00 a.m.; W. L. Bowler, chairman.
Refinery Inspection Supervisors (Subcommittee), 9:00 a.m.; H. F. West, chairman.

Saturday, Nov. 11

Emission Spectroscopy ((Subcommittee), 9:00 a.m.; R. O. Clark, chairman.
Tank Accessories and Cleanouts (Subcommittee), 9:00 a.m.; E. E. Kerns, chairman.
Corrosion (Subcommittee), 9:00 a.m.; M. S. Northrup, chairman.
Oxygenated Compounds (Subcommittee), 11:00 a.m.; W. H. Jones, chairman.
X-ray Diffraction (Subcommittee), 1:00 p.m.; E. B. Tucker, chairman.
Pressure-Relieving Systems (Subcommittee), 1:00 p.m.; J. C. Souder, chairman.
Refinery Valves (Manufacturers' Subcommittee), 2:00 p.m.; W. P. Kliment, chairman.
Nitrogen Determination (Subcommittee), 3:00 p.m.; G. Lake, chairman.
Trace Elements (Subcommittee), 5:00 p.m.; Harry Levin, chairman.

Sunday, Nov. 12

Petroleum Products (Committee), 9:00 a.m.; H. W. Field, chairman.
Unfired Pressure Vessels (Subcommittee), 9:00 a.m.; N. J. Rees, chairman.

Monday, Nov. 13

Mechanical Equipment (Subcommittee), 9:00 a.m.; E. F. Voss, chairman.
Valves (Subcommittee), 9:00 a.m.; Homer Reed, chairman.
Analytical Research (Committee), 9:00 a.m.; E. L. Baldeschwieler, chairman.
Automotive Research (Committee), 1:00 p.m.; D. P. Barnard, chairman.
Refinery Equipment (Committee), 1:00 p.m.; Bonner H. Barnes, chairman.
Advisory Committee, Division of Refining, 4:00 p.m.; John W. Newton, chairman.

Tuesday, Nov. 14

Program Committee, Division of Refining, 9:00 a.m.; W. M. Holaday, chairman.
Electrical Equipment (Subcommittee), 9:00 a.m.; L. M. Goldsmith, chairman.
General Committee, Division of Refining, 2:00 p.m.; Chester F. Smith, chairman.
Nominating Committee, Division of Refining, 5:00 p.m.; G. L. Neely, chairman.

5 Forums on Natural Gasoline Feature Fall CNGA Meeting

FIVE forums of particular interest to some phase of the natural gasoline industry will feature the Fall Meeting of the California Natural Gasoline Assn., to be held Nov. 9 and 10:

"Efficient Operation and Maintenance of Plant Equipment," conducted by J. B. Taylor, manager of the Gas Department, Signal Oil & Gas Co.

"Application of Chemical and Process Engineering Principles to the Efficient Design and Operation of Natural Gas Processing Plants," conducted by C. D. Gard, process engineer, Union Oil Co.

"Role of the Chemist and Laboratory in Efficient Natural Gas Operation," conducted by W. W. Robinson, Jr., chief chemist, Technical Service and Research Laboratory, Pacific Coast Division of The Texas Co.

"Efficient Mechanical Design of Natural Gas Processing and Compression Plants and Natural Gas Gathering and Distribution System," conducted by M. W. Kibre, manager, Natural Gas and Gasoline Department, General Petro'eum Corp.

"Efficient Management of Natural Gas and Natural Gasoline Operations," conducted by Wm. A. Kirk, California Southern Oil Co.

Time and locale of the forums will be announced later, according to M. L. Arnold, Richfield Oil Corp., general chairman of the meeting.

MEETINGS . . . for the Oil Man

OCTOBER

11-13, Fifth Annual Symposium on "Instrumentation for the Process Industries", Agricultural and Mechanical College of Texas, College Station, Texas.
12-13, Western Petroleum Refiners Assn., Regional Meeting, Gladstone Hotel, Casper, Wyoming.
15-21, National Oil Industry Information Committee, Oil Progress Week, Roosevelt Hotel, New Orleans.
16-20, National Safety Congress, National Safety Council Exposition, Chicago.
23-27, American Institute of Electrical Engineers, Fall General Meeting, Skirvin Hotel, Oklahoma City.
23-27, American Society for Metals, Annual Meeting, Chicago.
23-27, American Welding Society, Annual Meeting, Chicago.
24, Assn. of Consulting Chemists and Chemical Engineers, Inc., Annual Meeting, Shelburne Hotel, Skyline Room, New York.
27, National Gasoline Assn. of America, Southern Regional Meeting, Blackstone Hotel, Tyler, Texas.
30-Nov. 1, National Lubricating Grease Institute, 18th Annual Meeting, Edgewater Beach Hotel, Chicago.

NOVEMBER

2-3, Society of Automotive Engineers, Diesel Engine Meeting, Knickerbocker Hotel, Chicago.
2-3, Eighth Annual Pittsburgh X-Ray and Electron Diffraction Conference, Mellon Institute for Industrial Research, Pittsburgh.
9-10, Society of Automotive Engineers, Fuels and Lubricants Meeting, Mayo Hotel, Tulsa.
9-10, California Natural Gasoline Assn., Fall Meeting.
13-16, American Petroleum Institute, 30th Annual Meeting, Biltmore and Ambassador Hotels, Los Angeles.
13-17, National Electrical Manufacturers Assn., Chalfonte-Haddon Hall, Atlantic City.
14-15, American Society for Testing Materials, Committee D-20 on Plastics, Cincinnati, Ohio.
26-Dec. 1, American Society of Mechanical Engineers, Annual Meeting, Hotel Statler, New York.
27-Dec. 3, 19th Exposition of Power and Mechanical Engineering, Grand Central Palace New York.

DECEMBER

3-6, American Institute of Chemical Engineers, 43rd Annual Meeting, Neil House, Columbus, Ohio.

Book Reviews

Handbook on Cost Estimation Useful to Chemical Engineers

Chemical Engineering Cost Estimation, by Robert S. Aries and Robert D. Newton; 8½ x 11 in., 109 pages, heavy paper binding, illustrated, $5.00. Chemonomics, Inc., 400 Madison Avenue, New York 17, N. Y.

Chemical Engineering Cost Estimation comprises a new handbook which may prove to be a helpful tool to engineers in the chemical process industries who are faced with making accurate cost estimates quickly on new plants, new processes, new products, or new equipment. It provides for the use of graphical methods in estimating costs on major pieces of equipment, piping, insulation, and other auxiliaries. Useful ratios are presented for the calculation of complete plant, investment, and operating costs so as to obtain a rapid estimate of profit for management appraisal of new projects.

The graphs for equipment cover such items as cyclone separators, evaporators, towers, agitated vessels, crushing and grinding units, furnaces, tanks, steam jet ejectors, heat exchangers, pumps, motors, compressors, piping, and many others. Annual indexes of equipment costs are included. A series of methods of estimating cover such subjects as piping, instrumentation, maintenance, utilities, patent costs and royalties.

The book has been printed by the offset method from original material in typewritten form and from various types of charts and graphs. Reproduction on the whole is fairly good except for some of the cross-sectional charts. In those the lettering on the charts is blurred to some extent, reducing legibility.

The authors are Robert S. Aries, president, R. S. Aries & Associates, consulting engineers and economists; and Robert D. Newton, chemical engineer, Charles Pfizer & Co. Inc.

Process Heat Transfer Text Stresses Practical Aspects

Process Heat Transfer, by Donald Q Kern; 6 x 9 in., xii + 871 pages, stiff cloth binding, illustrated, indexed, $8.00. McGraw-Hill Book Co., Inc., 330 West 42nd Street, New York 18, N. Y.

Where once—not too many years ago—instruction in chemical engineering at the collegiate level could be well covered with one or, at most, two textbooks, today finds this same infant science (infant in comparison with ancient crafts like civil or military engineering) demanding many books each dealing with specific phases of the overall subject.

Process Heat Transfer represents just such a book. Its chief object has been to provide fundamental instruction in heat transfer, while employing the language and methods of industry. That is good. It is a way of treating the subject evolved for a course given at Polytechnic Institute of Brooklyn over a period of years. An aside remark at this point is in order: it is high time other portions of the chemical engineering curricula were given the same practical treatment with a thorough overhaul.

The author explains in his preface that the provision of a rounded group of heat-transfer tools required in process engineering has necessitated the presentation of a number of empirical calculations methods which have not appeared previously in the engineering literature. Considerable thought and numerous conferences with engineers preceded their inclusion.

Chapter headings typify fairly well the kind of information presented. They include such topics as conduction, convection, radiation, counterflow type exchangers, flow arrangement for increased heat recovery, streamline flow and free convection, condensation of single and mixed vapors, direct-contact transfer such as cooling towers, batch and unsteady state processes, furnace calculations, and many others.

Author Kern is director of the process engineering division, Patterson Foundry & Machine Co., and adjunct professor of chemical engineering at the Polytechnic Institute of Brooklyn.

New Approach to the Study Of Processing Operations

Unit Operations, by George Granger Brown, Chairman of the Department of Chemical and Metallurgical Engineering, University of Michigan, and 11 associate authors; 11 x 9 ins.; 611 pages, including nomenclature, appendix and index, stiff cloth binding, $7.50, John Wiley & Sons, Inc., New York.

The basic principle for the study of unit processing operations which has been followed in the preparation of this textbook, *Unit Operations*, is set forth in the preface; "The association and comparison of similar operations from different industrial processes is the essence of unit operations and the major factor in developing chemical, metallurgical or process engineers capable of successfully designing new plants for conducting new processes." The unit operations discussed are grouped according to similarities in action or in methods calculation and are presented in sequence according to increasing difficulty. Modern practice and equipment are emphasized, as well as mathematical interpretations, since, it is stated; "Only by properly designed, constructed and operated equipment can mathematical treatment yield useful results."

Part I covers unit operations treating solids alone, such as mechanical size separation, size reduction and conveying. Part II discusses liquids in the solid boundary phase, which is involved, whether the solid particles are flowing through the liquid, as in classification and flotation, or whether the fluid is flowing through a solid as in fluid transportation or filtration. Operations involving transfer of material from one phase to another are treated in Part III, including leaching (solid to liquid), extraction (liquid to liquid), gas absorption and distillation (vapor to liquid), and adsorption (fluid to solid). Part IV covers heat transfer and evaporation.

Authors associated with Dr. Brown in the preparation of the book include Professors Alan Shivers Foust, Donald LaVerne Katz and Richard Schneidewind, of the University of Michigan Engineering staff and 8 others, all but one on the Michigan teaching staff. George Martin Brown is Associate Professor of Chemical Engineering at Northwestern University.

Arc Welding Techniques Are Covered by Two New Manuals

Electric Arc Welding Procedure and Practice, 5½ x 8 in., 544 pages, leatherette binding, illustrated, indexed, $3.00. Hobart Trade School, Box EW 146, Troy, Ohio.

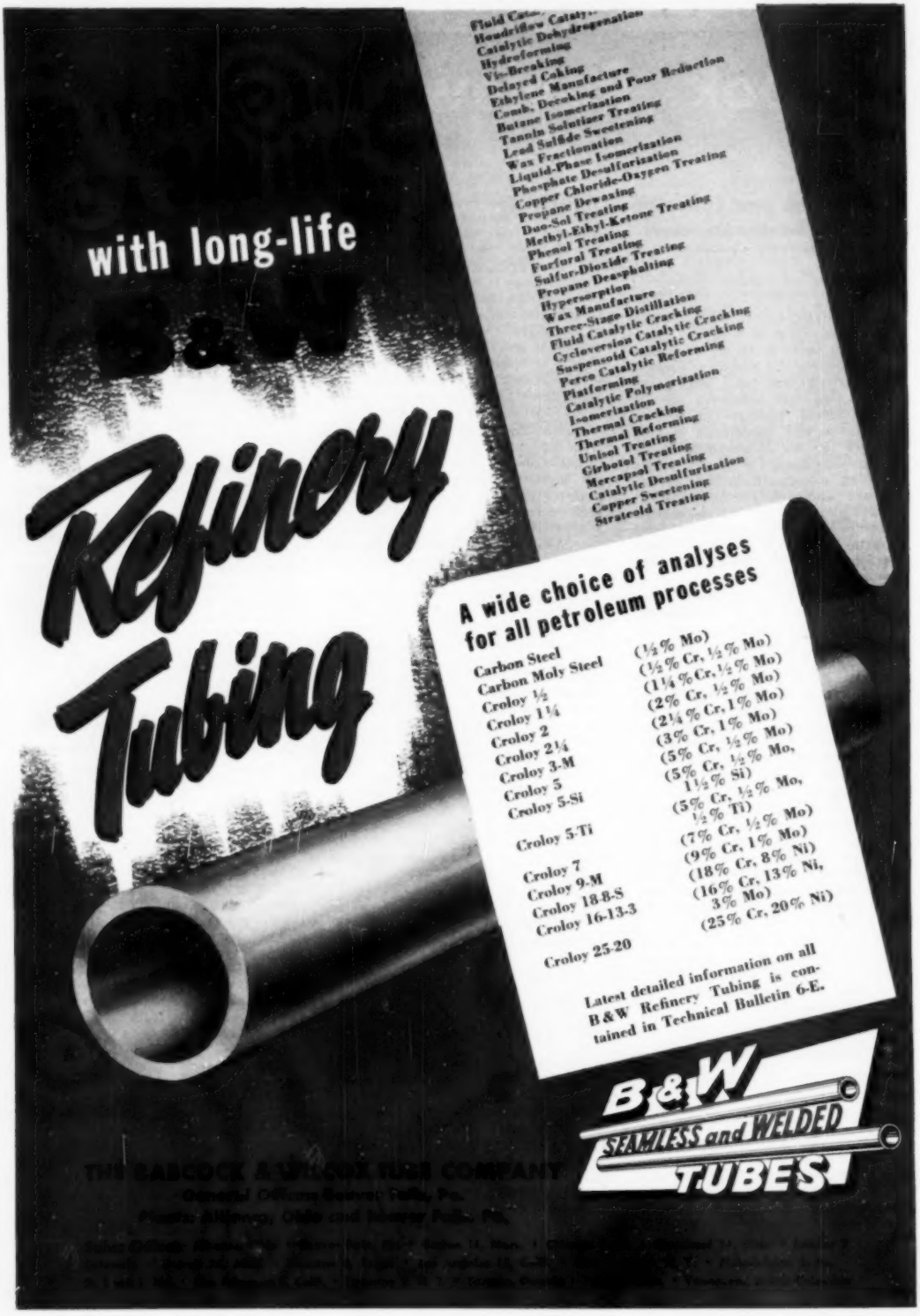
Procedure Handbook of Arc Welding Design and Practice, 9th Edition, 6 x 9 in., xi + 1199 pages, simulated leather binding, illustrated, indexed, $2.00. Lincoln Electric Co., Cleveland, Ohio.

The growth of welding over the past couple of decades, particularly in the petroleum industry, has played a very important role in the growth of that industry. This phenomenal tool, especially that type which employs the electrically-produced arc, has meant more to both new construction and routine maintenance work than many persons perhaps realize.

Two leading manufacturers have here published new manuals for the use of this important tool. Both books will be of value not only to students and practicing welders and welding engineers but also to executives and supervisors interested in the subject.

Hobart's *Electric Arc Welding Procedure and Practice* has 28 chapters covering five general phases of the field: 1) general information, 2) operator training course, 3) carbon arc welding and cutting, 4) other welding processes, and 5) welding terms and their definitions.

The first part discusses the devel-


with long-life
Refinery Tubing
Fluid Cata...
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opment of electric arc welding, describes applications, available metals and alloys, joints and welds, electrodes, equipment, and other basic procedures.

Part Two constitutes a complete self-study course, incorporating review summaries, practical exercises, and "quiz" questions. Part Three describes in detail the principles and practical operations of carbon arc welding. Part Four covers other processes such as inert-gas-shielded arc welding, submerged arc welding, and electric stud welding. The last part reproduces the terms and their definitions of the American Welding Society. The entire book has been well illustrated with over 600 photographs of operations, diagrams, and charts.

Lincoln has been publishing its *Procedure Handbook of Arc Welding Design and Practice* since 1933. This latest edition represents a thorough reorganization and re-editing of previous information as well as recent important welding developments. New design data has been included to make the handbook more helpful to designers. Latest procedures are given for welding all metals and alloys commonly welded with manual open and hidden arc welding as well as automatic and semi-automatic hidden arc welding.

A completely new chapter has been written on weldability. The section on structural design has been enlarged and revised to include more information on welded rigid framing. A completely new chapter has been added on welded design data.

Science of Petroleum Series Revived in Volume on Crudes

The Science of Petroleum, Vol. V, Part 1: *Crude Oils, Chemical and Physical Properties*, edited by B. T. Brooks, A. E. Dunstan, and others; 8 x 11 in., 200 pages, illustrated, indexed, $11.00. (Printed in Great Britain). Oxford University Press, 114 Fifth Avenue, New York 11, N. Y.

Vol. 5 of the series on *The Science of Petroleum* represents the first publication of this highly valuable work since 1937. The present book, Part 1 of Vol. 5, deals with chemistry, physics, and chemical engineering of petroleum. It is planned to issue two further parts which will complete the work of bringing up to date this section on the subject.

Technical and scientific literature on petroleum is scattered through a large number of excellent technical journals. It is the purpose of the editors of this book to bring together this record of the past 12 years by means of contributions by authors of highest standing who are able to review and evaluate this mass of literature. Because of the obviously far greater amount of work being done in the United States, the contributions from Americans form the greater part of the volume.

The book is divided into two major sections. The first deals with crude oil statistics, covering those of the U. S., 1933-45, and of Venezuela, Saudi Arabia, Bahrein Island, and the Middle East. It also deals with the evaluation of crude oils and oil stocks and economic developments in the petroleum industry. The second section presents the chemical and physical properties of petroleum hydrocarbons, including the paraffins, the naphthenes, the aromatics, olefins and diolefins, mechanism of organic reactions, chemical thermodynamic properties, and high-pressure vapor-liquid equilibria in cycling operations.

A fine tribute to this monumental work is contained in the foreword by Robert T. Haslam:

"Petroleum technology has advanced tremendously during the past several years. In the field of production knowledge of the factors that led to more efficient recovery of oil from the earth has been greatly extended. This is reflected in a large increase in recoverable oil reserves. In the refining field many outstanding new processes have been developed, such as catalytic cracking, alkylation, production of synthetic toluene, and production of synthetic rubber and its raw materials from petroleum. As a result of these and other developments, refining has become, to a considerable extent, a large-scale, organic synthesis operation wherein selected classes of materials are produced. The advances in petroleum technology have been too rapid for the literature in the field to give a reasonably complete picture of developments, and textbooks are not available which fully reflect the changes.

"The editors and the publisher of the new volumes of the *Science of Petroleum* are, therefore, to be congratulated on the real contribution they have made in providing in usable form an authoritative reference which brings up to date our information on petroleum technology. It is particularly fortunate that these volumes will appear at a time when there is such definite need for sound information on the nature and influences of the new techniques that today characterize the petroleum industry. The leading petroleum technologists who have contributed papers are to be highly complimented. Their efforts reflect the progressive spirit of the petroleum industry in co-operating to render a service to the public."

Mr. Haslam refers to such advisory editors and contributors of this book as M. R. Fenske, F. H. Garner, E. R. Gilliland, J. Bennet Hill, E. V. Murphree, D. A. Howes, Frederick D. Rossini, K. M. Watson, W. L. Nelson, A. N. Sachanen, D. L. Katz, the late F. C. Whitmore, and many other men.

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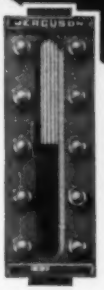

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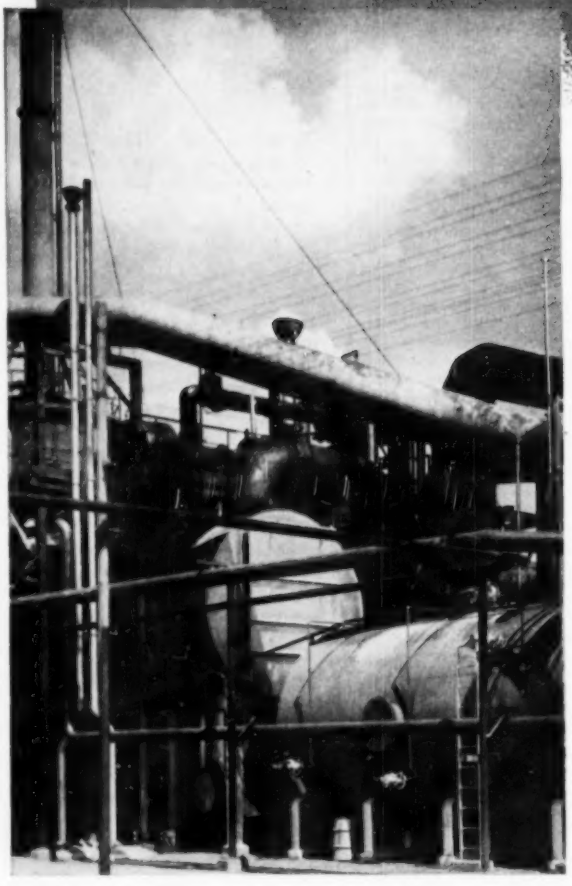

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REFINING TRENDS

Brunt of Coming Demand for Residuals Will Fall on Refinery Output, Imports

September plant operations indicate: First easing of crude runs since Korean war started. . . . Continued high rate of motor fuel production, while gasoline stocks trend toward leveling off in what is normally a month when gasoline stocks decline. . . . Drop in demand at refineries for heating oils, indicating satisfactory supplies in distributors' and consumers' hands. . . . Rate of summer buildup in heating oil stocks indicates total on Oct. 31 will be near that of Oct. 31, '49. . . . Volume of refinery production of heavy fuel oil continues to increase, but stocks remain at low level. . . .

Crude Runs: Indicated total runs of around 5,990,000 b/d in September, about 100,000 b/d below August, are around 70,000 b/d below the recent Bureau of Mines forecast for the 3d and 4th quarters. Increase in the volume of crude processed in recent months has been almost entirely in domestic crude, foreign oil run to stills averaging 450,000 to 500,000 b/d throughout the year thus far. Runs of domestic crude are about 10% above the same time in 1949, while for the early months they were below the 1949 rate.

Motor Fuel: Motor fuel supply, while around 100,000 b/d under August, continues at a high rate both compared with 1949 operations and also compared with demand. Indicated total output in September was at a rate 8.3% above a year ago, while for 8 months rate of supply has been only about 5% higher. Indicated rate of demand in September was 6% above a year ago, about the same rate as for total demand for 8 months.

The indicated trend was toward a leveling off of gasoline stocks in September, while stocks normally decline in this month. Stocks may level off at not far from the low point of 101,800,000 bbls. reached Sept. 30, '49.

Heating Oils: Production of kerosine and distillate fuels together is currently 15% above operations of a year ago, which is the same rate of increase as for total 8 months operations. Indicated demand in September, however, is about 6% above a year ago, while total demand for 8 months is close to 18% higher than in 1949. This would indicate an easing up on demands on refiners for secondary storage requirements. Since the start of the Korean war, stocks of heating oils (kerosine and distillate fuels) have built up by nearly 28,000,000 bbls., as against a buildup of 21,500,000 bbls. from June 30-Sept. 30, 1949. With a warm fall stocks may build up above the Oct. 31, 1949, total of about 118,000,000 bbls.

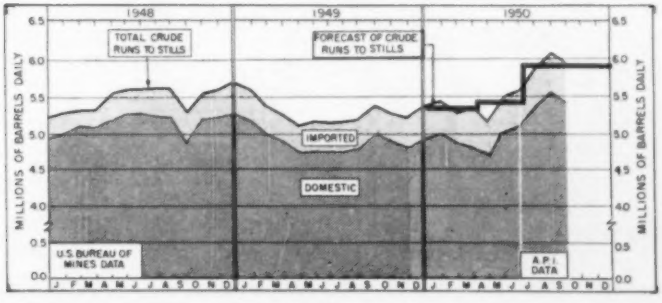
Residual Fuels: Conditions with heavy fuel oils are recognized as reaching a point where supply in coming months will depend on refinery output and imports rather than withdrawals from stocks. For 8 months to Sept. 1 total supply of this product was 347,250,000 bbls. while demand on refiners was 368,750,000 bbls. The resulting decline in stocks has been practically entirely in California stocks, which were drawn on for over 19,000,000 bbls. during the 8 months.

California stocks of residuals on Sept. 1, around 14,700,000 bbls., are at their lowest point in several years, likely even lower than California companies now desire considering West Coast activity in connection with the Korean war. It seems unlikely they will be further reduced by shipments to the East Coast. Demand for this product has been at a rate that has allowed residual fuel oil stocks for the U. S. except California to build up by only a few million barrels this year. See Fig. 7. In terms of forecast demand stocks are at their lowest point in 3 years.

Higher Crude Runs Are Forecast

The revised forecast of the U. S. Bureau of Mines (Aug. 28) indicates crude runs to stills the last quarter of 1950 will average 5,902,000 b/d. This is about 5% higher than the forecast made in June and nearly 10% higher than actual crude runs the last quarter of 1949. Forecast demand for all products except kerosine has been revised upwards. Total product demand for 1950 is now forecast at about 9% higher than actual 1949 demand.

Fig. 1, Moderate Drop in September Crude Runs



Crude Runs to Stills

Daily Average (1000 bbls.)

	Domestic	Foreign	TOTAL
Sept. '50 API*	5,470	520	5,990
Sept. '49 BM	5,004	423	5,427
Change	+466	+97	+563
% Change	9.3	22.9	10.4

* Through Sept. 23

Total (1000 bbls.)
(Bureau of Mines Data)

8 Mo. '50*	1,237,773	114,507	1,352,276
8 Mo. '49	1,187,602	100,032	1,287,634
Change	+50,171	+14,471	+64,642
% Change	4.2	14.4	5.0

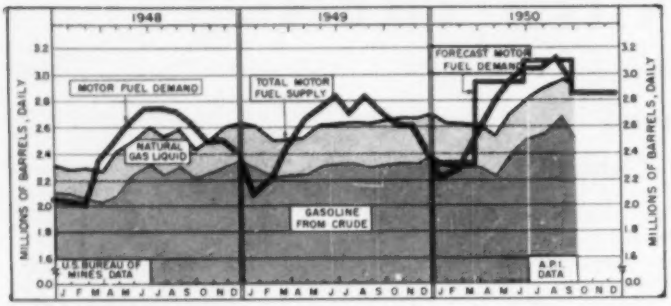
*August from API data.

BM Forecast of Runs to Stills
(1000 b/d avg.—Revised Aug. 28)
3rd Quar., 5,920; 4th Quar., 5,920; 1950, 5,869

Yields on Crude Runs to Stills

	Gasoline %	Kerosine %	Dist. Fuels %	Resid. Fuels %
Sept. '50 API	42.9	5.3	18.6	19.7
Aug. '50 API	43.9	5.2	17.8	19.2
July '50 BM	44.3	5.0	17.5	19.8
Sept. '49 BM	43.7	5.0	18.4	20.4

Fig. 2, Motor Fuel Supply Holds at High Rate



Natural Gas Liquids include natural gasoline blended at refineries, and used direct as motor fuel.

Fig. 3, Gasoline Stocks Level Off in September

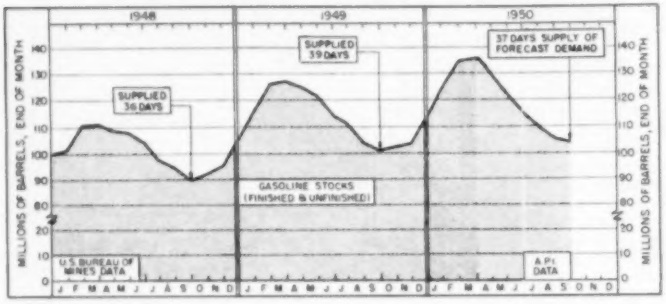

1948
1949
1950
SUPPLIED 36 DAYS
SUPPLIED 39 DAYS
37 DAYS SUPPLY OF FORECAST DEMAND
GASOLINE STOCKS (FINISHED & UNFINISHED)
U.S. BUREAU OF MINES DATA
API DATA
MILLIONS OF BARRELS, END OF MONTH
J F M A M J J A S O N D

Fig. 4, Heating Oils Output 15% Above 1949

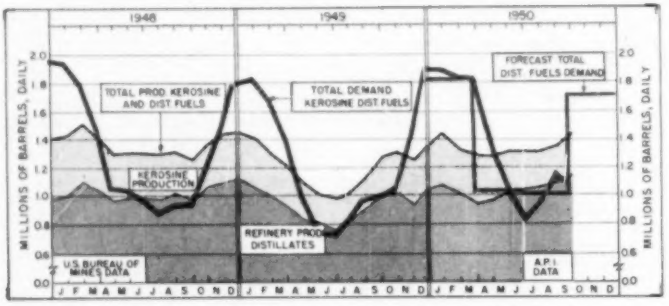
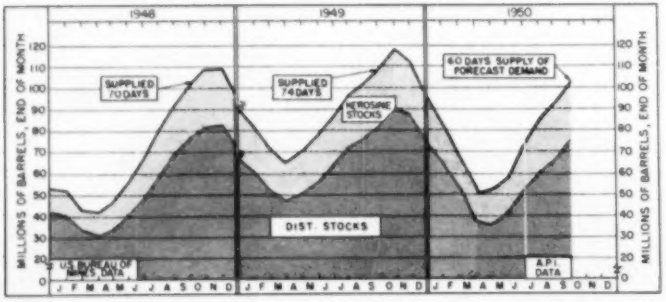


Fig. 5, High Rate of Buildup for Heating Oil Stocks



* Change in reporting in California eliminated 4,500,000 bbls. from distillate classification.

Motor Fuel Supply

Daily Average (1000 bbls.)

	Gasoline from Crude	Natural Blended Used Direct	TOTAL
Sept. '50 API*	2,579	330	2,909
Sept. '49 BM	2,368	309	2,677
Change	+202	+21	+223
% Change	8.5	6.8	8.3

* Through Sept. 23

Total (1000 bbls.) (Bureau of Mines Data)

8 Mo. '50	590,221	77,640	667,861
8 Mo. '49	564,267	70,781	635,048
Change	+25,954	+6,859	+32,813
% Change	4.6	9.7	5.2

* August from API data

Motor Fuel Demand

Including Exports
Daily Average (1000 bbls.)

Sept. '50 API*	2,950
Sept. '49 BM	2,779
Change	+171
% Change	6.1

* Through Sept. 23

Total (1000 bbls.) (Bureau of Mines Data)

8 Mo. '50*	670,199
8 Mo. '49	630,993
Change	+39,206
% Change	6.2

* August from API data

BM Forecast of Motor Fuel Demand
(1000 b/d avg.—Revised Aug. 28)
3rd Quar., 3,109; 4th Quar., 2,845; 1950, 2,781

Gasoline Stocks

Finished and unfinished, end of month (1000 bbls.)

Sept. '50 API*	104,739
Aug. '50 API	105,670
July '50 BM	111,055
Sept. '49 BM	101,799

* On Sept. 23

Heating Oils Production

(Kerosine and Distillates)
Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
Sept. '50 API*	320	1,141	1,461
Sept. '49 BM	270	1,002	1,272
Change	+50	+139	+189
% Change	18.5	13.8	14.8

* Through Sept. 23

Total (1000 bbls.) (Bureau of Mines Data)

8 Mo. '50*	76,693	247,390	324,083
8 Mo. '49	64,692	217,588	282,280
Change	+12,001	+29,802	+41,803
% Change	18.5	13.9	14.8

* August from API data

Heating Oils Demand

Daily Average (1000 bbls.)

	Kerosine	Dist. Fuels	TOTAL
Sept. '50 API*	225	845	1,070
Sept. '49 BM	231	777	1,008
Change	−6	+68	+62
% Change	2.6	8.9	6.1

* Through Sept. 23

Total (1000 bbls.) (Bureau of Mines Data)

8 Mo. '50*	72,647	256,272	328,919
8 Mo. '49	63,097	215,985	279,082
Change	+9,550	+40,287	+49,837
% Change	15.1	18.6	17.8

* August from API data

BM Forecast of Heating Oils Demand
(1000 b/d avg.—Revised Aug. 28)
3rd Quar., 1027; 4th Quar., 1703; 1950, 1408

Heating Oils Stocks

(1000 bbls. end of month)

	Kerosine	Dist. Fuels	TOTAL
Sept. '50 API*	27,632	75,079	102,711
Aug. '50 API	25,429	68,226	93,655
July '50 BM	23,412	61,757	85,169
Sept. '49 BM	26,650	63,213	109,863

* On Sept. 23

Fig. 6, Residuals Supply-Demand About in Balance

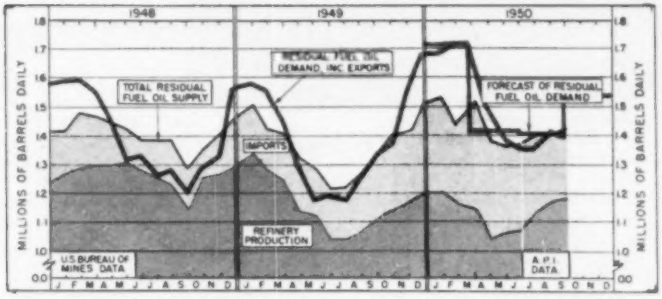
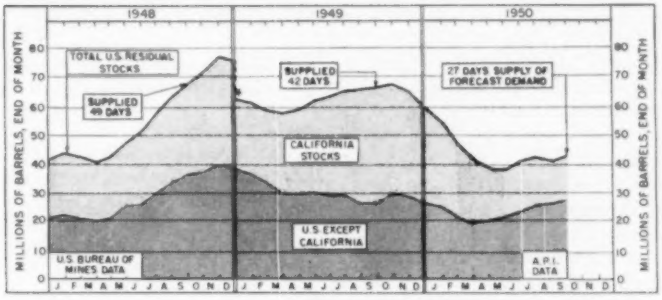


Fig. 7, "Resid" Stocks Low in Terms of Days' Demand



* Change in reporting in California eliminated 13,000,000 bbls. from residual classification.

Residual Fuels Production

Daily Average (1000 bbls.)

	Refinery Output	Imports	TOTAL
Sept. '50 API*	1,180	255	1,435
Sept. '49 BM	1,110	236	1,346
Change	+70	+19	+89
% Change	6.3	8.0	6.6

* Through Sept. 23

Total (1000 bbls.) (Bureau of Mines Data)

8 Mo. '50*	274,134	73,113	347,247
8 Mo. '49	283,475	41,922	325,397
Change	—9,341	+31,191	+21,850
% Change	3.3	74.4	6.7

* August from API data

Residual Fuels Demand

Daily Average (1000 bbls.)

Sept. '50 API*	1,400
Sept. '49 BM	1,346
Change	+54
% Change	4.0

* Through Sept. 23

Total Demand (1000 bbls.)

8 Mo. '50*	368,732
8 Mo. '49	326,089
Change	+42,643
% Change	13.1

* August from API data

BM Forecast of Residual Fuel Demand (1000 bbl avg.—Revised Aug. 28)

3rd Quar., 1,405; 4th Quar., 1,554; 1950, 1520

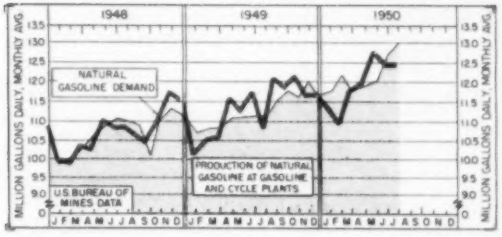
Residual Fuel Stocks

1000 bbls end of month

	U.S. Except California	Total U.S.
Sept. '50 API*	27,990	42,319
Aug. '50 API	26,735	41,512
July '50 BM	25,424	42,165
Sept. '49 BM	27,217	67,117

* On Sept. 23

Fig. 8, Production and Demand of Natural Gas Liquids


1948
1949
1950
MILLION GALLONS DAILY, MONTHLY AVG.
NATURAL GASOLINE DEMAND
PRODUCTION OF NATURAL GASOLINE AT GASOLINE AND CYCLE PLANTS
U.S.BUREAU OF MINES DATA
J F M A M J J A S O N D

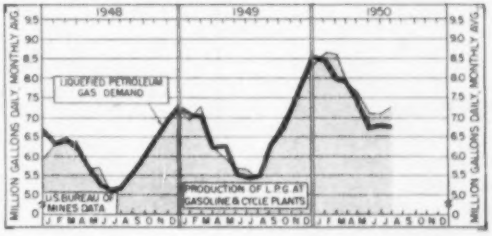
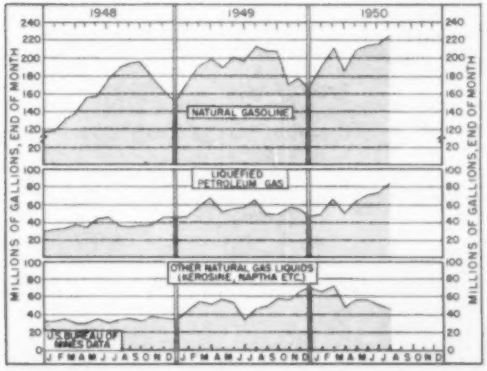

1948
1949
1950
MILLION GALLONS DAILY, MONTHLY AVG.
LIQUEFIED PETROLEUM GAS DEMAND
PRODUCTION OF L.P.G. AT GASOLINE & CYCLE PLANTS
U.S.BUREAU OF MINES DATA
J F M A M J J A S O N D

Fig. 9, Stocks of Natural Gas Liquids


1948
1949
1950
MILLIONS OF GALLONS, END OF MONTH
NATURAL GASOLINE
LIQUEFIED PETROLEUM GAS
OTHER NATURAL GAS LIQUIDS (KEROSINE, NAPTHA ETC.)
U.S.BUREAU OF MINES DATA
J F M A M J J A S O N D

Natural Gas Liquids Statistics

(Source: U.S. Bureau of Mines Report on Natural Gasoline and Cycle Plant Operations)

	Production (1000 gal./day avg.) Natural Gasoline	LPG**	TOTAL	Demand* (1000 gal./day avg.) Natural Gasoline	LPG	TOTAL
July '50	13,008	7,295	20,303	12,457	6,934	19,391
July '49	11,280	5,612	16,892	10,950	5,580	16,530
Change	1,728	1,683	3,411	1,507	1,354	2,861
% Change	15.3	29.9	20.2	13.7	24.3	17.3
	Total Production (1000 gal.)			Total Demand (1000 gal.)		
7 Mo. '50	2,585,436	1,644,011	4,229,447	2,545,895	1,607,531	4,153,426
7 Mo. '49	2,341,820	1,314,287	3,656,107	2,337,277	1,309,948	3,647,225
Change	243,616	329,724	573,340	208,618	297,583	506,201
% Change	10.4	24.9	15.6	8.9	22.9	13.8

	Stocks, End of Month (1000 gal.) By Type of Product: Natural Gasoline	LPG	Other Products†	By Location: Refineries	Gasoline Plants	TOTAL
July '50	228,256	85,722	52,676	129,120	246,534	366,654
June '50	216,326	72,920	53,080	113,612	228,674	342,326
July '49	210,380	62,061	45,846	92,148	226,139	318,287

* Demand, including exports but not transfers, is supplied from receipts from outside sources as well as current production and stock changes at gasoline plants. Outside receipts totaled 465,000 gals. in June.

** Does not include LPG produced at refineries which in June totaled 100,674,000 gals.

† Includes naphtha, kerosine, specialty and other products.

ADVERTISERS' INDEX

FOR INFORMATION ON ANY PRODUCT OR SERVICE ADVERTISED IN THIS ISSUE SEE INSTRUCTIONS BELOW

Each advertiser listed in this index has been assigned a code letter for use by the reader in securing additional information about advertised products or services which interest him. This code letter appears in parentheses to the left of the advertiser's name.

Circle the code letter on the "Advertised Product Inquiry" card (on the page opposite) which corresponds to that assigned the advertiser about whose product you want further information.

Fill in your name, title, company and mailing address and mail the card. . .no postage is required.

The Petroleum Processing Reader Service Department will give your inquiries prompt and efficient handling.

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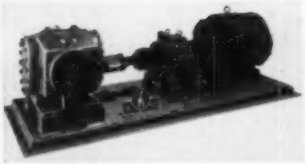
What's New!

EQUIPMENT . . . MATERIALS . . . PROCESSES . . . LITERATURE

Reviewed by WILLIAM C. UHL, Equipment Editor



Jacketed Herringbone Gear Pumps Handle Hot and Viscous Liquids

Viscous liquids such as hot road oils at high temperatures can be handled in a new steam-jacketed herringbone gear pump recently announced. To insure even thermal distribution, the steam jacket on the pumps completely covers the internal parts. The inlet, outlet, and cover flanges are cast integrally with the pump base, and rigid housing construction eliminates any possibility of distortion due to pipe line strain or misalignment. Straight bore housing also prevents shaft deflection and bearing overhang. Shafts are of heavy duty alloy steel, finish ground. Pressure on the stuffing box is dissipated through a channel in the cover plates. Steam connections on the jackets are designed to permit a variety of piping arrangements. Complete rotor and bearing assembly can be removed as a unit by releasing the coupling and removing the rear cover. Pumps are available in Meehanite B, cast steel, bronze, or special alloy case. Internal parts are built to specifications. Schutte and Koerting Co.

Circle No. **1** *on Reply Card*

For More Information

Use one of the attached reply cards to request additional information or literature on any items reviewed in "What's New!" Just circle the numbers corresponding to the numbers on the items you're interested in, fill in the rest of the card, and drop it in the mail. No postage required.

Gasket and Thread Sealing Compound Resists Most Hydrocarbons, Solvents

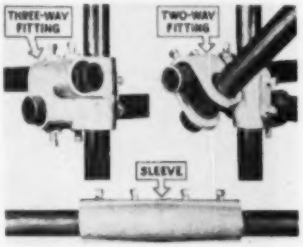
A new sealing compound for threaded joints and gasket surfaces called "Leak-Lock" is said to resist a wide range of materials, including aromatic and chlorinated solvents, gasoline—including 100 octane, oil, "Freons", methyl chloride, sulfur dioxide, carbon tetrachloride, butane, propane, benzene, etc. Its dielectric properties enable it to be used as an insulator. The product sets up approximately three times faster than other joint sealing compounds that do not become hard or brittle. It remains plastic enough to permit easy disassembly. Highside Chemicals Co.

Circle No. **2** *on Reply Card*

Mobile Tube Rolling Unit Includes Expansion Control, all Accessories

The Airetool Tube Expansion Control, now available as a compact, mobile unit provides a convenient way to handle the manufacturer's tube expansion equipment. Complete unit consists of a welded steel frame truck on which the control system, extra motors, expanders, mandrels, cables, and accessory equipment are easily accessible shelves. The tube rolling control itself is designed to produce accurate, uniform results when rolling heat exchanger and condenser tubes. It automatically stops expansion when the tube is properly rolled. It is precalibrated and may be set for the tube size and tube sheet thickness being worked. Airetool Mfg. Co.

Circle No. **3** *on Reply Card*

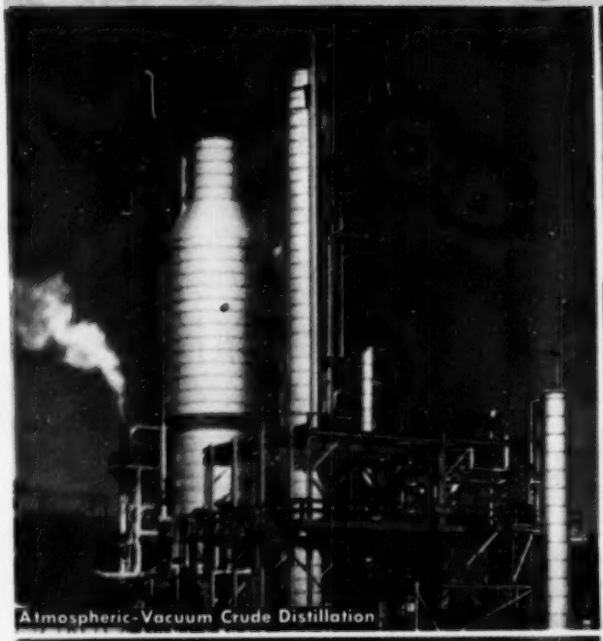


Special Fittings Enable Erecting Safe Scaffolds with Standard 1-in. Piping

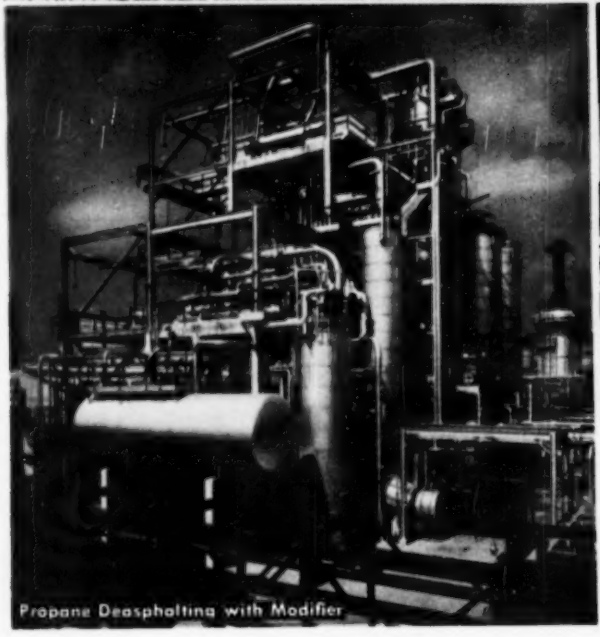
Quickly erected, all-metal scaffolding may be made up using "Amidon" patented fittings and standard pipe. The pipe can be fastened together by one or more of the following type of fittings: 1) Three-Way, for connecting longitudinal, transverse, and vertical pipe into a single corner joint, and for attaching one or two diagonal braces; 2) Two-Way, for fastening two pipes at right angles, as in attaching single diagonals, outboard brackets, guard rails, and ladder rungs, or for building the scaffold around vessels, tanks, etc.; 3) Sleeve, for joining lengths of pipe and for attaching casters. Erection consists only of sliding the pipe into the fittings and tightening two set screws at each joint. One man can do the job. Knocked down, the pipe and fittings take little storage space. For example, a scaffold 6 ft. front-to-back, 66 ft. high, and 400 ft. long can be stored in a space 8 x 7 x 14 ft. With horizontal and vertical spacing of 66 in. between pipes, Amidon scaffolds of standard 1-in. pipe meet all state safety requirements for a safe working load of 3000 lbs. on each 66-in. square. Amidon Sales Co.

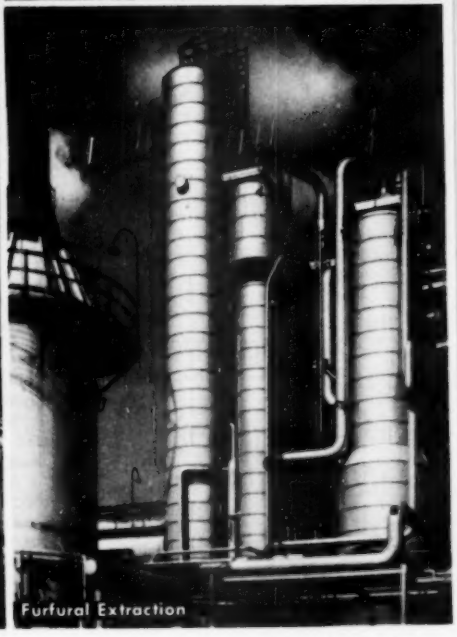
Circle No. **4** *on Reply Card*

Proof of


Atmospheric-Vacuum Crude Distillation

M.E.K. Dewaxing


Propane Deasphalting with Modifier


Furfural Extraction

Satisfaction

This crude distillation and lube oil finishing program plus gasoline and water treating facilities, in Paulsboro, N. J., recently completed by Badger for Socony-Vacuum Oil Company, Inc., represents a continuation of our services to the same client over a period of 23 years.

Badger regards repeat orders as fundamental indication of client satisfaction.

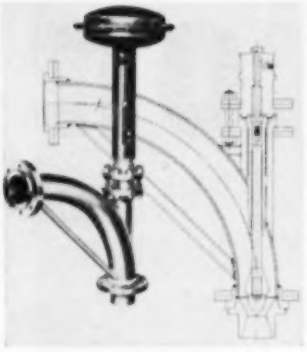
E. B. BADGER & SONS CO · Est. 1841

A SUBSIDIARY OF STONE & WEBSTER, INC

BOSTON 14 · NEW YORK

PARIS Etablissements Badger S.A. · LONDON E. B. Badger & Sons (Great Britain) Ltd

Process Engineers and Constructors for the Petroleum, Chemical and Petro-Chemical Industries



Control of Slurry Flow Is Improved In Novel Long Radius Angle Valve

Designed primarily to produce minimum turbulence in flow and for use on slurry service where suspended solids tend to plug a conventional type control valve, the new H-D 7000S Series "Flo-Tested" Long Sweep Angle Valve is being offered, in angle design only. The valve body is a long radius bend. It can be fabricated from any pipe that can be bent and welded. Frequently when a special alloy piping is required, a valve in the identical alloy is difficult to obtain. Where the piping is available, the valve manufacturer can supply a long sweep valve. Streamlined valve plugs are of high lift type. Seat is designed as a section of a Venturi throat, built as one piece and is the retained type, with no threads, being lapped into the body and retained by the compression of the line bolting. Maximum valve capacity is 50% of the corresponding manufacturer's "Venturiflo" valve. Long Sweep valves are available in any size from 2 to 6-in., with bodies of carbon steel, Type 304, 309, 316, and 347 stainless steel as standard. Any standard trim of the preceding alloys can be provided as well as Stellited trim. Standard spring range is 3-15 psi. Higher ranges can be provided. Hammel-Dahl Co.

Circle No. 5 on Reply Card

Automatic Circuit Breaker on Outlet Permits Safe Use in Hazardous Areas

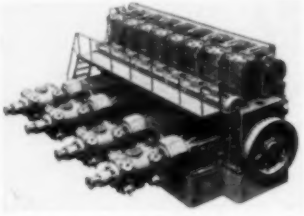
A new, safe interlock receptacle for hazardous locations incorporates a positive, safety cam lever which locks cord caps securely in the receptacle. This makes it impossible to remove the cord while the current is on. A flip of the interlock lever breaks the circuit while allowing plugs to be removed from the sockets. Standard flush type, single or duplex receptacles, fitting any conventional cord cap, are used. The interlock receptacle is available in capacities up to 20 amps. Panellit, Inc.

Circle No. 6 on Reply Card

Feedwater Sample Cooler Will Handle Refinery or Chemical Unit Samples

A new liquid sample cooler for boiler and boiler feedwater samples features a counterflow principle, making possible the cooling of liquid samples to temperatures approaching those of the inlet cooling media. Suitable for cooling samples required for controlling chemical and refinery processes or for general laboratory use, it is of stainless steel construction. It is a shell and tubular coil type heat exchanger of all welded construction designed so all connections are external to both cooling coil and jacket. Designed for 1500 psi. and 600° F. on the cooling coil side, and 150 psi. on the jacket side, the sampler has an outside diameter of 3⅝ in. and an overall length of 11¼ in. It is made in capacities of ¼ and ½ gpm. Worthington Pump & Machinery

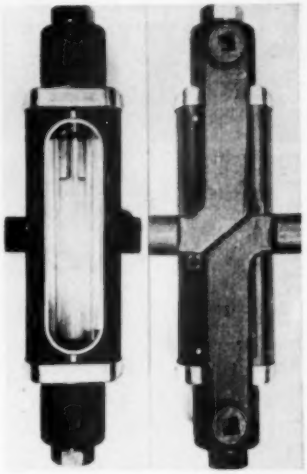
Circle No. 7 on Reply Card



Line of Reciprocating Compressors Designed for Natural Gasoline Plants

Designed for application in natural gasoline plants, chemical plants, transmission lines for gas, or wherever a compact, dependable compressor is needed, the new Model HLA Clark compressor is offered. It is built in two sizes: an eight-cylinder model of 2000 BHP and a ten-cylinder model of 2500 BHP. The units operate at 300 rpm., have a bore of 17 in. and a stroke of 19 in. Manufacturer states the fuel consumption curve from rated load to emergency overloads is essentially flat, making the HLA economical to operate over a wide range of conditions. The units have vertical power cylinders in line for maximum accessibility. Compressor and scavenger cylinders are in a horizontal position on one side of the crankcase to provide the optimum in space savings. Clark Bros. Co.

Circle No. 8 on Reply Card



New Adapter Provides for Horizontal Installation of Variable-area Meters

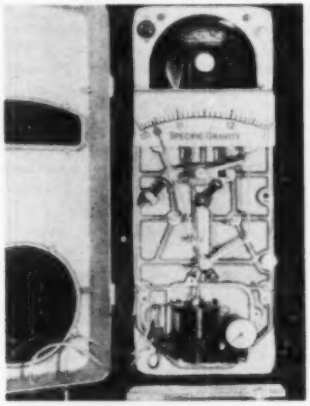
An adapter has been made available for installing "Flowrator" variable-area flow meters in horizontal process piping. It eliminates the need for a vertical rise in a line where head room is at a premium. The horizontal line adapter is constructed of a number of corrosion-resistant materials, bronze, carbon steel, and Type 316 Stainless steel, and may be supplied for use with all standard F&P meters. Fischer & Porter Co.

Circle No. 9 on Reply Card

Tilt-Divider Prevents Hand Injuries In Steel Parts Bins and Drawers

Fewer hand injuries to stockroom personnel is said to be a feature of the new "Equipto Tilt-Divider" Steel Drawer Separator. Designed for parts bins and drawers, it gives full visibility regardless of how full the drawer is. Because of the tilt design (see illustration) it helps to eliminate knuckle and finger injuries normally encountered with conventionally-designed dividers. The new dividers are being made standard on all of this manufacturer's drawer units, parts bins, and other equipment. Equipto.

Circle No. 10 on Reply Card



Gas Analyzer-Pneumatic Transmitter Combination Produces Useful Device

Two conventional instruments have been combined to make a new device for remote indicating, recording, or controlling of the specific gravity of natural or manufactured gases, process gas analysis, furnace atmospheres, or any vapors non-condensible at atmospheric temperatures. It is a combination of a "Ranarex" gas analyzer with a Fischer & Porter pneumatic transmitter. In the Ranarex, two impeller wheels are driven at constant speed and opposite directions. One pumps air and the other handles the gas to be analyzed. Both fluid streams are thrown against a corresponding pair of impulse wheels, which thus tend to rotate in opposite directions, the torque being greater on the one handling the denser stream. Rotation cannot be completed as the impulse wheels are coupled together by two levers and a connected link. But a limited movement is accomplished, its magnitude being proportional to the difference in specific gravities and the designed angular setting of the levers with respect to each other. A standard F&P pneumatic transmitter is attached to the lower lever arm and converts lever position to corresponding output pressures varying in accordance with Ranarex readings. This output signal is used to actuate remotely located receivers, recorders, controllers, and the like. Permutit Co., Ranarex Instrument Div.

Circle No. **11** *on Reply Card*

Plastic Process Equipment Resistant To Acidic Corrosives up to 350° F.

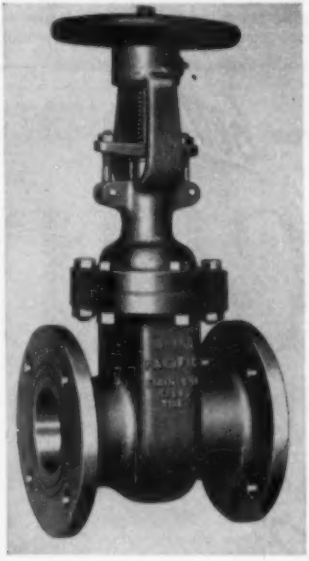
"Kemplas" is a new line of chemical process equipment made of synthetic resins of the modified phenolic type, either cold cast or laminated with glass cloth and molded into desired shapes. In a recent test, towers, pumps, and miscellaneous fittings of Kemplas showed no trace of corrosive attack after two years service in impure, 60% hydrofluoric acid at elevated temperatures. In another case, pumps lined with the material handled a combination of sulfuric and hydrofluoric acid at 160° F. for 12 times as long as any alloy or metal previously used. Cast pieces can be machined and threaded in the field and joined by cementing with the same resin as the parent material. Laminated pieces can be field-cut by ordinary machine shop techniques. The resins are stable up to 370° F.; recommended operating temperature maximum is 350° F. Now available are a wide range of castings, including Hills-McCanna valves, complete pumps, pipe fittings, and vessels up to 30-in. diameter. The resin was developed and produced by Pennsylvania Salt Mfg. Co.; the equipment is being manufactured by General Ceramics and Steatite Corp.

Circle No. **12** *on Reply Card*

Carrying Box for Extinguisher Opens Fast, Protects Unit from Weather

A box to hold fire extinguishers on petroleum products trucks has been designed for both quick access and maximum protection to the extinguisher. Developed and patented by a fleet maintenance man with Standard Oil Co. (Ohio), it is rapidly being made standard equipment on the company's trucks and is being considered for use on refinery extinguishers. Made of metal, the box is strong enough to withstand all climatic conditions. It is mountable on the truck frame. The box, which can be sealed with an inspector's seal, keeps the extinguisher clean and operable in any kind of weather. It is kept closed by double-locking clamps inside—a long handle enables the clamps to shut the box tightly and use the leverage of the handle to open the box easily. A tug at the handle disengages the locking bars, opens the box, and drops the extinguisher down on the now almost horizontal door, ready for use. The box is designed for 30-lb. dry chemical hand units, and is 13½ in. wide, 8½ in. deep, and 24 in. high. A larger, horizontal box is being designed for 50-lb. extinguishers. Fire Extinguisher Safety Carrier Co.

Circle No. **13** *on Reply Card*



Full Line of Stainless Steel Valves Offered for Refinery Requirements

A complete new line of stainless steel valves for refinery and chemical plant service has been added to the regular "Pacific" line of cast steel valves. They can be supplied from stocks on hand, the manufacturer states, cast of Type 316 stainless of Pacific Alloy 20. The line includes: (1) 150 lb., OS&Y, bolted bonnet gate valves, (see photograph) ⅛ to 8 in.; (2) 150 lb., swing check valve with bolted bonnet, ⅛ to 6 in.; (3) 150 lb., inside screw gate valve with screwed-in bonnet, ½ to 2 in.; (4) 150 lb., OS&Y, globe valve with bolted bonnet, ⅛ to 6 in.; (5) 300 lb. OS&Y globe valve, bolted bonnet, ⅛ to 1½ in.; and (6) 600 lb. OS&Y globe valve with bolted bonnet, ⅛ to 2 in. Pacific Valves, Inc.

Circle No. **14** *on Reply Card*

V-Ring Type Packing for Valve Seals Being Made of Highly Resistant Teflon

Teflon, the highly corrosion and heat-resistant plastic material, has

been made available in the form of "V-Ring" type packings. Known as "Chemlon" packing, the material is molded by a special process which combines the chemically inert and frictionless properties of Teflon with the resilience and toughness needed for proper results. The V-Rings are of particular application for valve packing, giving permanent sealing, under verying pressures, at temperatures up to 450° F. The rings are available in many standard sizes direct from stock. Additional sizes will be molded to meet specific requirements. Crane Packing Co.

Circle No. **15** *on Reply Card*

Formaldehyde-Alcohol Solutions Now Offered in Semi-Works Quantities

Solutions of formaldehyde in various types of alcohols are being made available for the first time by the chemical division of Celanese Corp. of America. Known as "Formcel," the new product is now being produced on a pilot plant scale at the company's Bishop, Texas, plant. It is currently being sold in semi-works quantities as 55% solutions of formaldehyde in methanol and 40% solutions in butanol, propanol, and methanol. Tests have proved the practicability of handling a relatively water free alcohol solution of formaldehyde at regular temperatures in standard equipment. Celanese Corp. of America.

Circle No. **16** *on Reply Card*

FOR *better* LUBE OIL, FUEL OIL, GREASE & GASOLINE

GLIDDOL

the Soybean Derivative by Glidden...

Pacemaker in Soya Research

Refiners of lubricating oil find in Gliddol a soybean additive that not only checks oxidation and reduces surface tension, which promotes thorough blending of oil and additives, but one that effectively disperses insoluble solids to give oils a longer life of usefulness and to provide greater protection for motors. In grease, this superior blending agent and inhibitor serves similar ends. In leaded and unleaded gasoline Gliddol acts as a protective colloid to prevent the formation of a precipitate and retards deterioration of the gasoline on exposure to sunlight. Fuel oil treated with Gliddol R shows less precipitate after long heating and has a lighter color than untreated oil.

For further details on the advantages of Gliddol and Gliddol products as they may be related to *your* produc, . . . consult Glidden, Pacemaker in Soya Research. The complete facilities of our Technical Service Department are always at your disposal.

The Glidden Company
SOYA PRODUCTS DIVISION
5165 W. Moffat Street
Chicago 39, Illinois

QUALITY Glidden PRODUCTS

Transparent Filter Pump Unit Offered For Filtration Runs up to 100 gph.

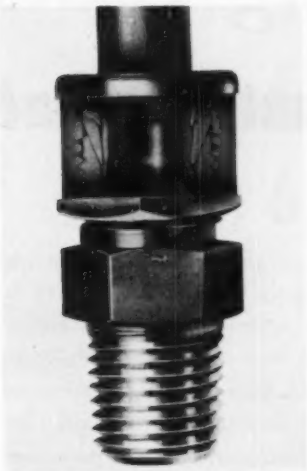
A number of advantages are cited by the manufacturer for a new filter pump equipped with a high temperature Lucite filter cylinder and a stainless steel pump, rated at 100 gals./hr. The Sethco Model LSI-10, has high resistance to many industrial and electroplating type solutions, and can operate at up to 200° F. The filter cylinder holds less than one quart of solution, all of which is recoverable. The filter tube can be backwashed or washed. Filtration progress can be watched through the transparent Lucite cylinder. Sethco.

Circle No. **17** *on Reply Card*

Glass Fiber-Synthetic Resin Produces Pipe or Tubing with Strength of Steel

A glass-fiber tube or pipe material with the strength of steel and designed as a possible replacement for steel or other critical war metals has been developed and is now available as piping for oil or chemical processing, or as tubing for electrical and allied fields. Known as "Glasweld," it is a laminated tubing in which glass fibers, in the form of cloth, mat, or tape, are bonded with resins. Much of the research for this material was done for the Navy, and it is now being used by the Army as well as in commercial applications. United States Plywood Corp.

Circle No. **18** *on Reply Card*



New Tubing Fittings Stop All Leaks In Instrument Line Connections

Small leaks in instrument lines can be completely eliminated by using "Swagelok" fittings, according to the manufacturer. A vacuum tight seal is provided by the two ferrules and the threaded chuck inside the nut which clinch tight around the tubing wall. Tests have shown the tubing will burst before the fitting will leak. The fittings will hold heavy or thin wall tubing. They are made for use with aluminum, brass, copper, steel, stainless steel, or plastic. No flaring of the tube is necessary in assembly. Fittings are available in brass, Monel, aluminum, steel, and stainless steel, in a range of sizes for tubing ⅛ to 1 in. O.D. Crawford Fitting Co.

Circle No. **19** *on Reply Card*

Penetration Test Timer Eliminates Any Possibilities of Human Errors

The new Precision Penetrometer Timer is said to make penetration measurements "absolute" by eliminating the possibility of human error. Instead of using a stopwatch, the operator flicks the timer control switch to the "ON" position. The needle is freed to allow penetration for exactly five seconds; it is then gripped and held immovable. Timing is made precise by a synchronous motor and cam actuating a microswitch to a solenoid that holds the needle shaft. The Timer doesn't modify procedures specified in ASTM Nos. D-5, D-217, and others. Tests on greases, bituminous materials, petrolatum, etc., can be carried on as usual. Precision Scientific Co.

Circle No. **20** *on Reply Card*

Trade Literature

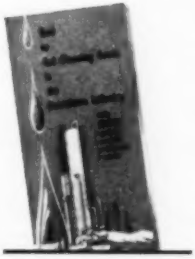
Meter Chart Computer

The Rockwell-EMCO Integrator, Bulletin 1016, Rev. 6, eight pages of complete catalog information, prices, and description of operation of an instrument which mechanically computes orifice meter charts, employing the square root cam principle and capable of being operated by semi-skilled technicians. Rockwell Mfg. Co.

Circle No. **21** *on Reply Card*

STORAGE TANKS

paint-stripped in less time—at less cost



BUT FAST—that's how old paint rolls off when you strip tanks the money-saving Oakite way.

Powerful Oakite strippers, applied by hot-flow-on, steam gun, or cold-flow-on method, actually float off paint, dirt and grease. You save time . . . no hand-scraping or chipping. You save money . . . long-life solution may be reclaimed and reused. No expensive sand blasting. And you're safe . . . no fire hazard.

Ask your local Oakite Technical Service Representative for on-the-spot demonstration. Or write for Booklet F7629. No obligation. Oakite Products, Inc., 44C Thames St., New York 6, N. Y.

SEND for this FREE Booklet. It is full of useful information on general maintenance . . . cleaning. Covers all divisions of the Petroleum Industry—production, processing, transportation, marketing.

Technical Service Representatives in Principal Cities of U. S. & Canada

OAKITE

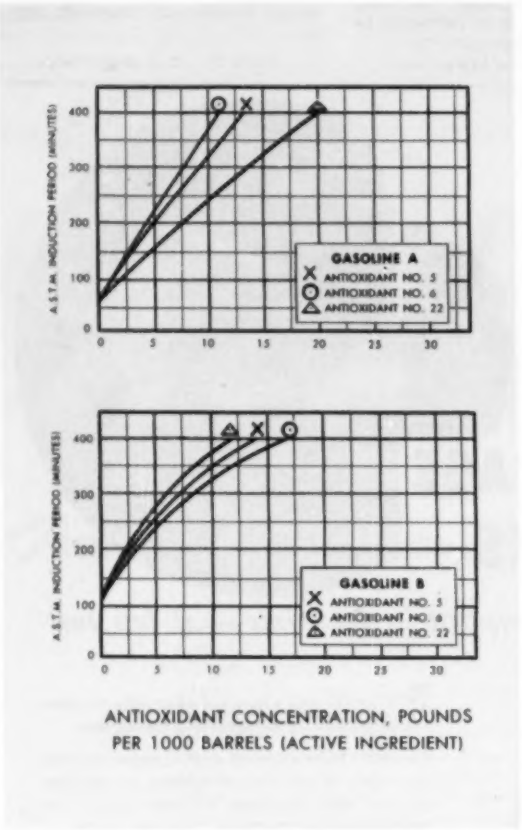
TRADE MARK REG. U. S. PAT. OFF.

PETROLEUM SERVICE DIVISION

[*To obtain more data on advertised products see page* 1116]

For Lower Treating Costs

Check all three Du Pont Gasoline



The above curves indicate the differences in induction period response of two different stocks to Antioxidants No. 5, No. 6 and No. 22. In stock A, the best response was obtained with Antioxidant No. 6, while in stock B, Antioxidant No. 22 was the most effective.

Regardless of the antioxidant treatment you have been using for your gasoline, it will be well worth your while to investigate thoroughly the three Du Pont Gasoline Antioxidants, Nos. 5, 6 and 22. Each has specific characteristics and usually, under any set of conditions, there is one antioxidant which will prove best for that application.

The relative efficiencies of Antioxidants Nos. 5, 6 and 22, as determined by accelerated laboratory tests such as induction period and "gum time," will vary with the gasoline in which they are tested. While in many gasolines there will be only minor differences in efficiency between the active antioxidant ingredients, in other gasolines the differences are sufficiently great to represent a real saving in cost when the most effective one is used. The curves opposite show marked differences in response between the three antioxidants in two different stocks.

Antioxidants Nos. 5 and 6 are generally to be preferred when control of copper dish gum is important. No. 22, because of its insolubility in water, usually works best where water extraction may be a problem. *To evaluate in your gasolines*—send for or ask your Du Pont Petroleum Chemicals representative for samples. The nearest Du Pont Field Laboratory will also be glad to check your gasoline stocks and recommend the most efficient antioxidant.

MAKE DU PONT THE SOURCE FOR ALL OF YOUR GASOLINE ADDITIVES

Tetraethyl Lead Compounds (Motor Mix—Aviation Mix) • Antioxidants • Metal Deactivator • Dyes

• • •

Antioxidants Nos. 5, 6, 22

No. 5

Antioxidant No. 5 is a solution containing 50% Normal-butyl-para-aminophenol, 30% anhydrous iso-propanol, and 20% anhydrous methanol.

PROPERTIES

Specific Gravity, 75°/75°F	0.90
Flash Point, °F	60 (Tag. C.C.)
Viscosity at 100°F, Saybolt Universal Seconds	41
Solidification Temperature, °F	−20
Range of use concentration, Weight %	0.002 to 0.01
Pounds per 1000 (42 gal.) barrels	5 to 25

No. 6

Antioxidant No. 6 is a solution containing 50% Iso-butyl-para-aminophenol, 30% anhydrous iso-propanol, and 20% anhydrous methanol.

PROPERTIES

Specific Gravity, 75°/75°F	0.90
Flash Point, °F	60 (Tag. C.C.)
Viscosity at 100°F, Saybolt Universal Seconds	41
Solidification Temperature, °F	0
Range of use concentration, Weight %	0.002 to 0.01
Pounds per 1000 (42 gal.) barrels	5 to 25

No. 22

Antioxidant No. 22 is a commercial grade of N,N'-di-secondary butyl-para-phenylenediamine containing no solvents.

PROPERTIES

Specific Gravity, 75°/75°F	0.94
Flash Point, °F	290 (Cleveland Open Cup)
Viscosity at 100°F, Saybolt Universal Seconds	64
Range of use concentration, Weight %	0.001 to 0.005
Pounds per 1000 (42 gal.) barrels	2.5 to 12.5

Send for this New Book!

Recently published, this new 24 page book provides complete information on Du Pont Gasoline Antioxidants. It also contains much helpful information on methods of antioxidant addition, methods of evaluating antioxidants, correct handling procedures and the like. For a copy, ask your Du Pont Petroleum Chemicals representative—or write the nearest District Office.

PARTIAL TABLE OF CONTENTS—

- History of antioxidant development
- Du Pont Gasoline Antioxidants —Composition and physical properties
- Mechanism of oxidation and function of the antioxidant
- Antioxidant efficiency
- Effect of treating on antioxidant response
- Methods of evaluation
- Point of antioxidant addition
- Methods of antioxidant addition
- Safe handling practices

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Yarway Impulse Steam Traps are suitable for any pressure up to specified maximum *without change of valve or seat.* Types available up to 1500 lbs. Simplifies installation and maintenance. Over 650,000 Yarway Traps already *proved on the job.* Sold by over 200 distributors. Bulletin T—1740 free.

YARNALL-WARING CO. 153 MERMAID AVENUE, PHILA. 18, PA.

What's New!

Remote Tank Gaging System

The Shand & Jurs Electronic Precision Remote Reading Tank Gauge System, Bulletin RREG-450; 10 pages covering operating principle of an electronically-operated automatic system for obtaining remote readings of multiple tank installation levels at large distances, in ft. and in. Shand and Jurs Co.

Circle No. 22 *on Reply Card*

Atomic Energy-Operated Level Gage

The Gagetron, Bulletin 149; four-page folder describing the operation and listing possible applications for a level measuring instrument actuated by radioactive gamma radiation. It can be used for measuring catalyst level in cracking units, liquid interface, etc., under extremes of pressure, temperature, and corrosion. (See pp. 1064-8, this issue of PETROLEUM PROCESSING, "Automatic Refineries No Longer a Dream"). Instruments, Inc.

Circle No. 23 *on Reply Card*

Rupture-Proof Bellows Flow Meter

Barton Flow Meters, Bulletin 11C4; eight pages describing operating principles of a bellows-type flow meter of rupture-proof construction, which includes a temperature compensator, pulsation dampener, range spring adjustment; for operating temperatures not to exceed 175° F. on continuous service. Barton Instrument Co.

Circle No. 24 *on Reply Card*

Aviation Gasoline Dye

Du Pont Oil Blue A; eight pages covering an improved blue gasoline dye developed especially for aviation gasolines, its history, use in military and other avgases, physical properties, handling and shipping instructions. E. I. du Pont de Nemours & Co.

Circle No. 25 *on Reply Card*

Moving Bed Catalytic Cracking

Houdry Pioneer, Vol. 5, No. 2, comprises an article on "The Correlation of Moving Bed Process Variables in Recycle Catalytic Cracking," indicating it is possible to 1) predict the product distribution at a given recycle ratio and temperature when the yield of one major product is known, 2) predict the product distribution at a given set of operating conditions, and 3) predict the operating conditions necessary at a given temperature and recycle ratio to obtain a specified yield of one major product. Houdry Process Corp.

Circle No. 26 *on Reply Card*

Synthetic Organic Chemicals

Physical Properties of Synthetic Organic Chemicals, 1951 Edition, Form No. 6136, a 16-page condensed guide of applications and physical properties of more than 250 synthetic organic chemicals, in tabular form. Carbide and Carbon Chemicals Division.

Circle No. **27** *on Reply Card*

Mixing without a Mixing Tank

"American" Homomix, Technical Supplement HM-1; gives data on a rapid-mix unit that accomplishes rapid, uniform blending of a liquid and one or more chemicals or gases with water, sewage, or industrial wastes, without the use of a mixing tank. The American Well Works.

Circle No. **28** *on Reply Card*

Petroleum Product Handling

Efficient Handling of Petroleum Products, a 20-page booklet describes regular and special services provided in inspection of products in shipment and in storage by some 350 persons stationed in offices and laboratories at the world's principal petroleum ports by the organization of the E. W. Saybolt & Co.

Circle No. **29** *on Reply Card*

Instrument Line Tubing

Instrument Lines of Alcoa Aluminum, Form AD-243; covers the use of aluminum tubing for instrument lines, including tables of typical mechanical properties, bursting pressures, conversion factors, and average coefficients of thermal expansion for two alloys. Aluminum Co. of America.

Circle No. **30** *on Reply Card*

Air-Cooled Heat Exchangers

Dri-Cooler, Bulletin DC-50; 12 pages describing three new models in forced-draft type, air-cooled heat transfer equipment designed primarily for engine jacket water but usable also for cooling natural gas, lube oils, fluids in refining units, ammonia or steam condensing, etc., in small to medium capacity ranges; including dimensions and weights, and rating tables for cooling water. The Marley Co., Inc.

Circle No. **31** *on Reply Card*

Lab or Process Viscometer

Brookfield Synchro-Lectric Viscometer; a pocket-size brochure covering a viscosity instrument for use in the laboratory or at the point of process, which employs a calibrated spring to measure the torque on a spindle rotating at constant speed in the material to be tested, with the dial graduated in centipoises. Brookfield Engrg. Laboratories, Inc.

Circle No. **32** *on Reply Card*

pH Instrumentation

pH Electrodes, Assemblies, Parts and Accessories, Catalog EN-S5, 28 pages on a complete line of this equipment for both industrial and laboratory applications, including chemical solution supplies, holders, and mountings. Leeds & Northrup Co.

Circle No. **33** *on Reply Card*

Mixing Equipment

Patterson Agitating and Mixing Equipment, Catalog No. 505; 32 pages covering portable power mixers, agitator-mixer assemblies and drives, outside-packed, side-entering agitators, acid-resistant linings for mixing tanks, etc., including specifications, and operation and application information. Patterson Foundry & Machine Co.

Circle No. **34** *on Reply Card*

Steam System Instruments

Spence Regulators, Condensed Catalog No. 350; a 32-page booklet with photos, charts, and tables giving capacity and flow data, dimensions and weights on main line valves, controls and strainers for steam systems, with details on thermostats, desuperheaters, flange standards, etc. Spence Engrg. Co., Inc.

Circle No. **35** *on Reply Card*

Direct Acting Flow Regulators

Kates Direct Acting Regulator, Bulletin 502; explains the operation of a flow regulator said to be completely self-contained and independent of air lines, electric current, remote valves, or other connected apparatus, for water, acids, or oils at high or low temperatures and pressures; specifications given for regulators from 0.1 to 100 gpm., with larger units available. W. A. Kates Co.

Circle No. **36** *on Reply Card*

LPG Tanks and Vessels

Tanks by Banks, 64 pages describing manufacturing facilities, and the types of products in a line including fabrication of liquefied petroleum gas storage tanks for above and underground installations, pressure vessels, scrubbers, absorbers, cooler boxes, gasoline storage tanks, and refinery process vessels. Dallas Tank Co., Inc.

Circle No. **37** *on Reply Card*

Diaphragm Motor Valves

Diaphragm Control Valves, Series 1200 and 1400; Bulletin No. S-10; four-page brochure giving specifications and describing new models in this type valve available in cast iron and most alloys, in sizes to 16 in., for ratings to 1500 psi., 1000° F. Kieley & Mueller, Inc.

Circle No. **38** *on Reply Card*

Chemical Consultants in Research

Research Facilities without Capital Investment; a 20-page brochure furnishing an answer to the question, What is the function of the chemical consultant in today's industrial research? Foster D. Snell, Inc.

Circle No. **39** *on Reply Card*

Thermocouples and Accessories

Thermocouples, Catalog No. 5; 16 pages of technical data and descriptive information on a complete line of thermocouples, protection tubes, wire, lead wires, insulators, and auxiliary parts for all makes of pyrometers. Arklay S. Richards Co., Inc.

Circle No. **40** *on Reply Card*

WEDGEPLUG
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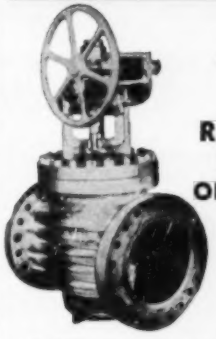
STEEL VALVES



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TURNS
and
RE-SEATS
IN ONE
OPERATION

• DRY PLUG •

PRICED to compete with conventional plug-type valves. Interchangeable with American Standard Steel Wedge Gate Valves. Wrench-Operated; Direct Handwheel-Operated; Worm Gear-Operated; Sizes from 1" to 16". Write for our Catalog No. 600 and Price List. On request, we will be glad to quote on larger sizes above 16".

Wedgeplug Valve Co., Inc.
Department "P"
New Orleans 15, U.S.A.

[*To obtain more data on advertised products see page* 1116]

Venturi Ball Valve

The New WKM Venturi Ball Valve, Bulletin No. 695, four pages describing a smooth throttling valve with a Venturi design body for full, straight through flow with low turbulence, and a ball "gate" to provide long wear and easy operation, with negligible pressure drop. W. K. M. Co.

Circle No. **41** *on Reply Card*

Liquid Level Controller

Magnetrol Liquid Level Controls; a four page brochure explaining the operating principle and giving a number of typical units in a line of liquid level controls which utilize a permanent magnetic force to transmit liquid level travel to the detecting mechanism, and can be used for almost any liquid at any temperature or pressure. Magnetrol, Inc.

Circle No. **42** *on Reply Card*

Recording Oxygen Analyzer

Beckman Recording Oxygen Analyzer, Model G, Bulletin 103; eight page brochure describing this instrument which utilizes the paramagnetic property of O_2 for actuation, listing possible applications, specifications, accessory equipment, and suggested sampling needs. Arnold O. Beckman, Inc.

Circle No. **43** *on Reply Card*

Portable Manometer

Meriam Model B-2862 Portable Field Manometer, Catalog Sheet B-2862; four pages describing operation, construction details, available ranges and scales, and giving prices on a small manometer designed for field testing low air or gas systems, or where readings of low pressures must be made with high accuracy, within 0.2 in. water column. Meriam Instrument Co.

Circle No. **44** *on Reply Card*

Laboratory Glass Equipment

What's New for the Laboratory, No. 11, 1950, features 20 new items adapted to laboratory use, including a tubular filter of fritted glass, an ASTM certified thermometer set, a flask with cork insulated top to prevent burns, a "Varicell" that eliminates storage batteries, and a new microscope lamp with optical control of light intensity. Scientific Glass Apparatus Co., Inc.

Circle No. **45** *on Reply Card*

Tube Rolling Tools

Ideal Tube Expanders, Bulletin No. 71, describes a line of tube rolling equipment with a ball-bearing-adjustable thrust collar, for heat transfer equipment with thin, thick, or multiple tube sheets, in tube sizes from ½ to 1½ in O. D., including sizes and prices. The Gustave Wiedeke Co.

Circle No. **46** *on Reply Card*

Potentiometers

Semi-Precision Potentiometers, the first in a series of papers entitled "Rubicon Notes" which are to provide information on potentiometers, resistance bridges, sensitive galvanometers, and the like; includes list of standard instruments, ranges, limits of error, description, and prices. Rubicon Co.

Circle No. **47** *on Reply Card*

For Your Convenience

Business reply cards are included in each issue of PETROLEUM PROCESSING to assist you in obtaining more information on any items reviewed in "What's New!" You'll find them facing the first page of this section. Just circle the numbers corresponding to the numbers at the end of each item in which you are interested. Then fill in the bottom of the card and drop it in the mail. No postage required.

CLASSIFIED

DISPLAYED: Advertisements set in special type or with border—$10.00 per column inch.
UNDISPLAYED: "For Sale", "Wanted to Buy", "Help Wanted", "Business Opportunities", Miscellaneous classifications set in type this size without border—25 cents a word. Minimum charge, $6.25 per insertion.

"Position Wanted"—10 cents a word. Minimum charge $2 per insertion. Box number counts 2 words. Copy must reach us by 5th of month preceding date of issue.
All classified advertisements are payable in advance.
No agency commission or cash discounts on classified advertisements.

PROJECT ENGINEER

Prominent Engineering and Construction Company, located in New York City, requires Project Engineers to coordinate and direct engineering work in connection with the design and construction of petroleum and chemical plants. M.E. or Ch.E. graduate with practical petroleum refinery engineering and construction experience required. Position is permanent with excellent promotional opportunities. Detailed resumé of experience and photograph desired at **BOX 35.**

POSITION OPEN

PROCESS ENGINEER: Permanent position on the process staff of an internationally known New York engineering firm for a top flight technical graduate with approximately five years experience in petroleum or petrochemical field. Candidate should be capable of assuming responsibility for process design. Salary high and commensurate with experience. All replies in confidence.

BOX 34

Project & Process Engineering
Water Conditioning Equipment
Petroleum Refinery Engineering
Chemical Plants

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Consulting Chemical Engineer

Registered Professional Engineer
State of Illinois
Associate Member A.I. Ch.E.

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Vicksburg 3271

An advertisement in PETROLEUM PROCESSING Classified Section will bring quick, effective results.

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PETROLEUM PROCESSING

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Personals

H. G. Mangelsdorf has been assigned to the Bayway refinery, Linden, N. J., of Esso Standard Oil Co. as general superintendent. He was formerly assistant general manager of the company's Baton Rouge refinery. **Charles Leet,** head of the technical division at

Mr. Mangelsdorf

Mr. Eiffe

Baton Rouge, succeeds him. **J. R. Eiffe,** general superintendent of the Bayway refinery, has been transferred to Baton Rouge as assistant to the general manager.

These changes are a further extension of a practice of rotational assignments in the management development program established by Esso five years ago. Others given new assignments under this program are:

F. A. L. Holloway, head of petroleum technical service department, who replaced Mr. Leet; **R. K. Dix,** head of the chemical technical service department, who replaced Mr. Holloway; **N. C. Dunn,** petroleum technical service section head, who replaced Mr. Dix.

Mr. Mangelsdorf joined Esso at the Baton Rouge refinery in 1934 as a process engineer. The next year he was made head of the process engineering department. In 1939 he became assistant head of the technical division, and in 1944 head of that division. In 1948 he was appointed assistant to the general manager and assistant general manager in 1949. He was graduated from Kansas State College in 1930 with a B.S. degree in electrical engineering. He received a M.S. degree in fuel and gas engineering from M.I.T. in 1932.

Mr. Leet was graduated from West Virginia University with a B.S. degree in chemical engineering in 1931. He started with Esso as a student engineer at the Bayway refinery in 1930 and came to Baton Rouge as a chemical engineer in 1931. He was made head of the processing engineering department in 1939 and head of the technical division in 1946.

Dr. Holloway came to Baton Rouge as a process engineer in 1939 after receiving a doctorate at M.I.T. He served successively as head of chemical technical service and assistant head of technical division before he was named head of petroleum technical service earlier this year.

Dr. Dix joined Esso as a member of their chemical technical service in 1943. He was made assistant head of the department in January, 1948, and department head in July, 1948. He is a graduate of Iowa State College and M.I.T., where he received his doctorate in chemical engineering.

Mr. Dunn joined the Baton Rouge refinery as a process engineer in 1941 and served as head of that department for several years before going to petroleum technical service. He holds a B.S. degree from the University of Wisconsin.

• • •

Frederick E. Frey, assistant director of research for Phillips Petroleum Co., has been named chairman-elect for the petroleum division of the American Chemical Society. He will serve in this office until September, 1951, when he will succeed B. H. Shoemaker of Standard Oil Co. (Ind.), present chairman.

Mr. Frey

Mr. Frey is a graduate of Ohio State University and the College of Wooster (Ohio). After being graduated from Ohio State he worked at the Bureau of Mines, Pittsburgh, for three years. He joined Phillips in 1927 as a research chemist. In 1947 he was selected by the Chicago section of the American Chemical Society as one of the ten outstanding petroleum chemists in the U. S. Wooster College awarded him the honorary degree of Doctor of Science in 1948. He received the Southwest Regional award for his outstanding contribution to the chemical profession in 1949.

Mr. Frey has been active in the American Chemical Society for many years and served as chairman of the Oklahoma section. At the present time he is a councilor for the northeast Oklahoma section and a member of the committee on constitution and by-laws of the national council.

• • •

Rolston L. Bond, former technical director of Cities Service Refining Corp.'s butadiene division at Lake Charles, La., has been made assistant chairman of the chemistry and chemical engineering department at the Armour Research Foundation, Illinois Institute of Technology, Chicago. He will be in charge of the Foundation's research activities in biochemistry and organic chemistry.

• • •

William T. Cravens has been named general superintendent of refinery operations for Cities Service Oil Co. (Del.) at Bartlesville, Okla. He had been assistant general superintendent since 1949.

Mr. Cravens

He was graduated from the University of Arkansas with a degree in chemical engineering in 1936. Following his graduation he served a year as a government project engineer before joining Cities Service as a junior engineer. His early training was with Arkansas Fuel Oil Co., Shreveport, La. In 1939, he was promoted to refinery engineer of their Bossier City plant. From 1942 to 1947 Cravens was employed as chief process engineer of Cities Service Refining Co., Lake Charles, La. Before his transfer to Cities Service Oil Co., Bartlesville, he was chief process engineer of the manufacturing division of Petroleum Advisers, Inc., New York City, a service organization of Cities Service Co.

• • •

W. O. Twaits has been elected director of Imperial Oil Ltd., Toronto, Canada, an affiliate of Standard Oil Co. (N. J.). He was formerly management assistant in the producing department, western division, at Calgary, Canada.

Mr. Twaits

Mr. Twaits was educated in Sarnia and Toronto, graduating in 1933 from the University of Toronto with a Bachelor of Commerce degree. He joined Imperial's manufacturing department at Sarnia the same year and after experience in the various refinery departments became production controller in 1940. In 1945 he was transferred to Toronto as assistant economic coordi-

nator and in 1947 was appointed manager of the coordination and economics department. In 1949 he moved to Calgary to receive his former position.

* * *

C. L. Parris has joined Pan-Am Southern Corp. as chief engineer in the technical department of their new El Dorado, Ark., refinery. He was formerly a civil and mechanical engineer with Standard Oil Co. (Ind.), Pan-Am's parent company. **Robert O. Robertson,** of the engineering inspection department of Indiana Standard's refinery at Whiting, Ind., has also joined Pan-Am at El Dorado.

Mr. Parris is a civil engineering graduate of the Texas Technological College and holds the degree of Master of Science in civil engineering at Illinois Institute of Technology. His experience includes work for the Texas Highway Department, for the International Boundary Commission for the United States and Mexico, and with the engineering department of Indiana Standard at Whiting. He joined the latter organization in May, 1942, and has been engaged in the design and construction of numerous refinery facilities. Mr. Parris has recently been engaged in working with engineering groups of the Foster-Wheeler Corp., New York, on the design of the new catalytic cracking unit under construction at the El Dorado refinery. He is a member of the American Society of Civil Engineers and is a registered professional engineer.

* * *

R. R. Jackson, manager of the Paulsboro, N. J., refinery of Socony-Vacuum and **S. D. Dalton,** manager of the refinery engineering division, have been appointed to the company's manufacturing committee at New York.

Mr. Jackson will be succeeded at Paulsboro by **E. L. Sinclair,** assistant manager. Mr. Dalton will also continue as manager of the refinery engineering division.

A graduate of the University of Texas, Mr. Jackson started in 1923 at Beaumont, Texas, in the refinery of the Magnolia Petroleum Co., an affiliate of Socony-Vacuum. Prior to becoming manager of the Paulsboro refinery in 1946, he was superintendent of the Beaumont refinery.

Mr. Dalton, who was graduated from Stanford University in 1930 and from the Massachusetts Institute of Technology in 1932, started in 1933 with the General Petroleum Corp., also an affiliate of Socony-Vacuum, at its refinery in Torrance, Calif., and was transferred to the Socony-Vacuum refinery engineering division in 1940.

Mr. Sinclair is a graduate of the University of Michigan and started with Socony-Vacuum 12 years ago. He has been associated with construction projects at the Paulsboro refinery for about three years and became assistant plant manager earlier this year.

* * *

Dr. Louis Schmerling, research chemist with Universal Oil Products Co., is the recipient of the 1951 Precision Scientific Co. Award in Petroleum Chemistry. The presentation will take place at the national meeting of the American Chemical Society in 1951. The $1000 cash prize, which is administered by the ACS, was created to stimulate research achievements in petroleum chemistry in the U. S. and Canada.

Dr. Schmerling

A native of Milwaukee, Dr. Schmerling received his early education there and his B.S. in chemistry from the University of Wisconsin in 1932 and his Ph.D. from Northwestern University in 1935. He has been with Universal since leaving school. Among his accomplishments is the clarification of the mechanism of alkylation of isoparaffins, as used in the manufacture of high octane aviation gasoline. In 1947 he was selected as the first winner of the triennial $3000 Ipatieff Prize in Chemistry for outstanding experimental work in the field of catalysis.

* * *

J. R. Bailey, former assistant director of natural gasoline and gas operations for Continental Oil Co. has been promoted to director. **C. L. Ritter,** former superintendent, natural gasoline and gas operations, has been promoted to assistant director, succeeding Bailey.

Mr. Bailey, who replaces **F. B. Haverfield,** resigned, has been with Continental 23 years. He attended Colorado School of Mines, at Golden, and joined Continental in 1927 in the refinery at Glenrock, Wyo. Through various promotions he later served at the company refinery at Baltimore, Md., and in district engineering work in Louisiana. He moved to Ponca City, Okla., in 1942 as division engineer in natural gasoline and gas operations, became superintendent of development in 1947 and assistant director in 1949. Bailey

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FOR APPLICATIONS IN NATURAL GASOLINE & CYCLING PLANTS, PUMPING STATIONS, REFINERIES, ETC.
Illustrated, at top: Model G Indicating Thermometer, flush mounting type with capillary tubing for remote reading. Priced from $18. At bottom: Model V Thermometer (vapor pressure type). Rigid stem for direct mounting. Priced from $10.25.
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TOLEDO 1, OHIO
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INDICATING & RECORDING THERMOMETERS

moved to Houston early this summer when executive offices were transferred there.

Mr. Ritter, a graduate of Colorado State College, Fort Collins, joined Continental in the production department in 1935 at Lance Creek, Wyo. Ritter rose through various promotions that carried him to Tepetate, La.; Houston; and Ponca City, Okla. There he became superintendent of operations in 1946. He also was transferred to Houston early this summer.

* * *

Milton A. Dewey heads a newly created tetraethyl lead sales department in Canadian Industries Ltd., which will handle Canadian sales of Du Pont tetraethyl lead antiknock compounds and other petroleum additives. He will have headquarters in Toronto, with a branch office in Montreal.

Mr. Dewey

Following graduation from the University of Illinois in 1931 with a B. S. in chemical engineering, Mr. Dewey worked in the experimental laboratories of Mid-Continent Petroleum Corp., Tulsa. He held a research fellowship at Pennsylvania State College sponsored by the Pennsylvania Grade Crude Oil Assn. and was later in charge of the analytical laboratory of Gulf Research and Development Corp. He came to the Du Pont company in 1937 and has served in petroleum chemicals research and sales.

* * *

R. A. Winslow has been named assistant head of Esso Standard Oil Co.'s design group in the process-engineering department at the Baton Rouge refinery. **N. F. Black** has been placed in charge of standby and storage activities at the Plancor 152 plant and has been appointed general foreman of the new utilities department. **G. F. Sellem** has been appointed division-foreman assistant. **L. B. Page** has been named division foreman in charge of the isobutylene and diolefin-extraction units, alcohol department.

* * *

Albert S. Orr has been appointed director of Gulf Oil Co.'s refinery technology laboratory in Philadelphia. **T. L. Cantrell** has been named assistant director. These promotions follow the retirement of **Herschel G. Smith,** former manager of the laboratory.

Mr. Orr is a graduate in chemical engineering of the A & M College of Texas. He joined Gulf as a chemist in the experimental laboratory at the Port Arthur, Texas, refinery in 1924. In 1930 he was transferred to the new laboratories in Philadelphia. For the past ten years he has been general foreman of the refinery technology division and assistant to Mr. Smith.

Mr. Cantrell is a graduate chemist and was educated at Rice Institute, the University of Pennsylvania and Temple University. He was first employed by Gulf in the experimental laboratory at Port Arthur in 1930. Later that year he was transferred to the refinery technology division in Philadelphia.

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R. F. Howe has been named general foreman of butyl operations in the chemical products division at Esso Standard Oil Co.'s Baton Rouge refinery. He has been replaced as head of the refining and cracking section of the refinery by **B. E. Nystrom.** Mr. Nystrom was formerly head of the crude distillation and products group, and is succeeded by **J. D. Midwikis.**

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R. C. Underwood has been named superintendent and **Aultman T. Smith** assistant superintendent of Sunray Oil Corp.'s refinery at Sunray (Dunxan), Okla.

Mr. Underwood began his refining career with the Rock Island Refining Co. in 1927. In 1943 he joined Associated Refiners, Inc., former operators of the now Sunray-owned Duncan refinery. He joined Sunray in 1947 as assistant refinery superintendent.

Mr. Smith started in the oil business with the Cosden Oil Corp. in 1933. In 1943 he also joined Associated Refiners, Inc., and started with Sunray in 1947 as shift superintendent.

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Dr. Gustav Egloff has been elected a member of the Society of Military Engineers, Washington, D. C., and a Fellow in the Royal Society of Arts of Great Britain. He is director of research with Universal Oil Products Co.

* * *

Gordon Kiddoo has been appointed director of research and development for Continental Carbon Co., Amarillo, Texas. He previously was with The Texas Co. in chemical engineering processing work, and in the design, construction and operation of pilot plants for the synthesis of fuels. Mr. Kiddoo performed similar duties for Hydrocarbon Research, Inc., of Olean, N. Y. He is a graduate of Cornell University with a degree in chemical engineering.

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EDITORIAL VIEWPOINTS...

Opinions and Comments on Current Topics

Reservists Not Being Deferred

THE refining companies are being handicapped, and the nation's war mobilization program will be delayed, because of the present policy of the Armed Services in calling up members of the reserves in key positions in the plants and development laboratories. Not only are reservists being taken into the service without their companies having an opportunity to make applications for delay in recall prior to the men leaving their jobs. Also, under the present procedure for appealing a recall order, in many cases the refinery managers or their representatives have not been able to learn the name of the officer or military board to whom they should present requests for deferment in specific cases.

The general instructions issued some weeks ago by the Armed Services called for requests for deferments to be made to the commanding officer of the particular branch of the service, in the area or district where the reservist was located. The actual procedure for handling such requests is determined by that officer. One refinery manager, who has already lost eight key technologists from his company, made a trip to Washington and talked with various officials there, but he still does not know the name of the officer who will actually consider and pass on the request for delay in recall in the case of one man particularly important to the company because of his technical training and experience.

In the last war, the drafting of men whose services would have been of far greater aid in the war effort had they been kept on their jobs was recognized as something to be avoided in any coming military mobilization of manpower. At the request of Washington, preliminary studies were made by industry and professional societies, to provide general data on the technically trained men in essential jobs who should be subject to delay in calling into the Armed Services. A sub-committee of the National Petroleum Council made such a study, in the oil industry, at the request of the National Security Resources Board.

No use has been made of these studies, as far as we know, and nothing has been issued which could aid military personnel in passing on applications for deferment of reservists in key positions. This personnel in most cases, by geographical location and training, is far removed from any actual knowledge of conditions in any specific appeal, and even of the importance of the industry involved. The war effort in the refining industry, and in many other industries as well, will suffer until the present practice in recalling reservists is changed.

Lewis Tyranny Threatens

IT IS generally understood in the chemical industry that the Lewis brothers, John L. and Denny, are seeking to gain domination of workers in that industry, and that the recent strikes in the alkali plants are a part of their strategy. Lewis moved in on the alkali plants through his catch-all union, District 50, United Mine Workers, and in some of the plants he won the right to represent the workers in bargaining, in place of the established AFL chemical workers' union.

If the Lewis brothers can gain domination of the chemical manufacturing business they will have a stranglehold on another key industry in the nation's war effort, to replace the coal industry they have despoiled. Their strike at the alkali plants created a severe shortage in soda ash, a chemical vitally important to petroleum refiners. The paralysis Lewis created in the coal industry is at least partly responsible for the shortage of benzene, another chemical vital to the war effort. Continued recurrence of strikes in the coal mines has held down the production of benzene, authorities in the chemical industry claim, and the petroleum companies as yet are very limited manufacturers of this product.

The stakes will be high for Lewis in their fight to control the chemical manufacturing business and some of the oil companies will be directly interested through their petrochemical plants. The chief weapons Lewis used to break the coal industry were industry-wide bargaining and union control of pension funds set up by the companies. No price should be too high for the chemical and allied companies to avoid these avenues leading to union domination.

Defense Starts at Home

LACKING the presence of anti-aircraft guns and other visible paraphernalia of military defense, it will be difficult for some refinery managers and operating personnel to realize the need for strengthening their own internal security programs in the present emergency. This need does exist, however, and even for plants not directly supplying wartime materials, since their own establishment could be involved through attack or extensive sabotage efforts directed at some factory in the neighborhood, or at their community.

In these present days, our military preparedness and defense efforts cannot proceed on the basis there is a hard and fast line between war and peace, for such is not the case, deplorable as this may be in the relations between nations. Wars start now with sudden open attacks, preceded by subversive work by enemy agents. The new industrial plant security manual of the Defense Department, "Principles of Plant Protection," suggests that plant management adopt the premise that espionage efforts are today under way in their works, to secure data on war contracts, new products and process developments and other information that would be important to an enemy nation planning an attack. In fact, this could well be true even now in some refineries and other industrial plants. A program to strengthen the plant internal security program set up on this basis should lead to a more effective plan.

The Defense Department bulletin gives many general suggestions that will aid in drafting a program for the individual plant. It shows the important role that safety and fire protection department heads must take in the revised internal security program. The bulletin, reviewed on pg. 1063 of this issue, should be "must" reading for refinery managers and department heads. Another recent government bulletin, "The Effects of Atomic Weapons", while technical in content, is also recommended for study by those planning new refinery internal security programs.

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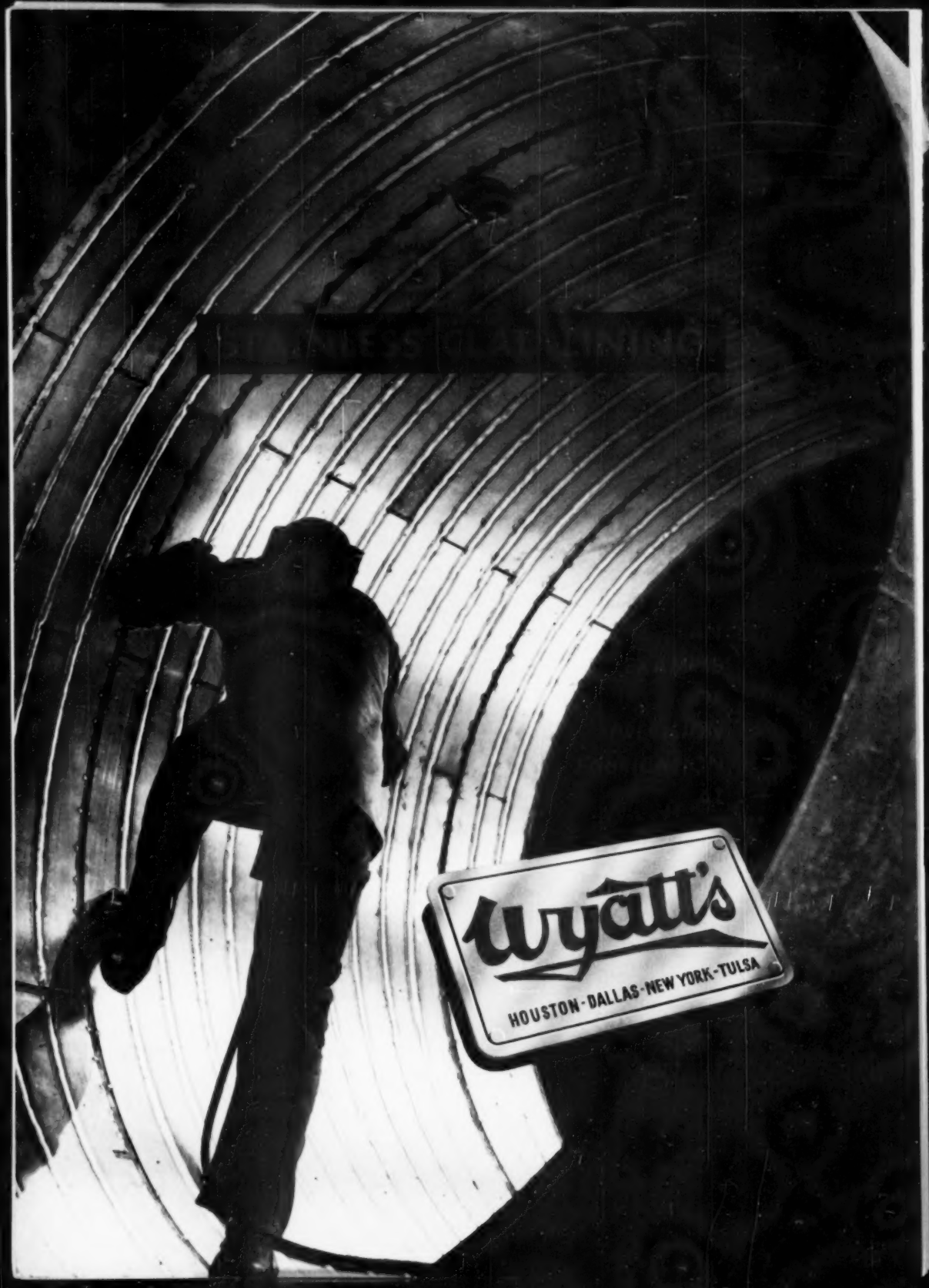
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